PROTECTIVE SHELTERS for ARCHAEOLOGICAL SITES



Proceedings of a SYMPOSIUM

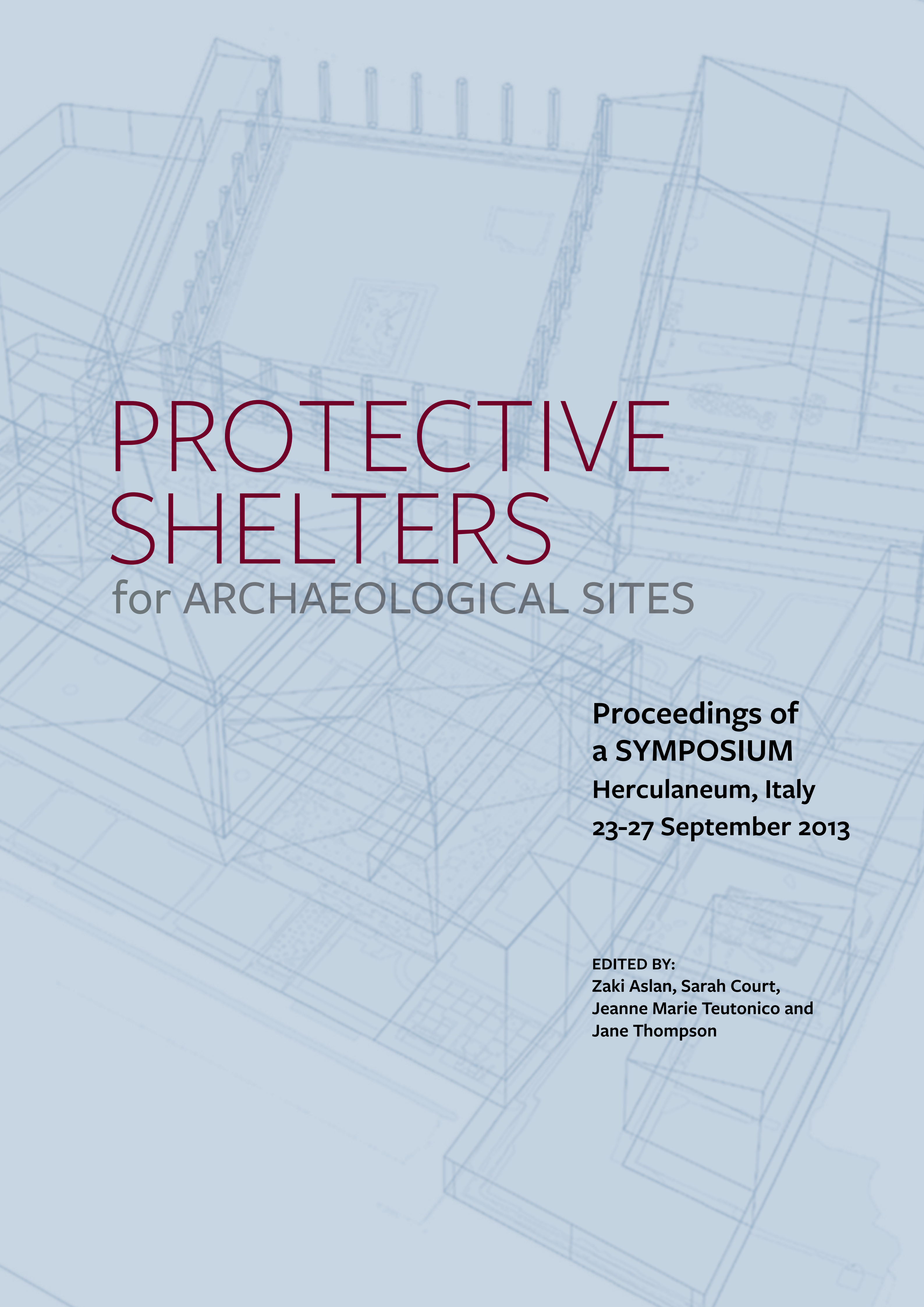
Herculaneum, Italy

23-27 September 2013

EDITED BY:
Zaki Aslan, Sarah Court,
Jeanne Marie Teutonico and
Jane Thompson

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BRITISH SCHOOL
AT ROME

MOSAIKON



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Protective Shelters for Archaeological Sites: proceedings of a symposium
(Herculaneum, Italy, 23–27 September 2013)

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ISBN: 978-0-904152-79-1

10 Carlton House Terrace, London, SW1Y 5AH
www.bsr.ac.uk
A charity registered in England and Wales (no. 314176)

Designer: Maxtudio
Cover images: Studio Architetto Rizzi and John Stewart
Publications support: Katherine Wallis

This is the publication of the proceedings of a symposium held in Herculaneum, Italy in September 2013. It was organized by the British School at Rome, as part of its partnership with the Packard Humanities Institute and the Soprintendenza Speciale per i Beni Archeologici di Napoli e Pompei, known as the Herculaneum Conservation Project. This project was completed as part of MOSAIKON, a joint initiative of the Getty Conservation Institute, the Getty Foundation, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and the International Committee for the Conservation of Mosaics (ICCM) to improve the care and preservation of ancient mosaics in the greater Mediterranean. Major support for this publication was provided by a grant from the Getty Foundation. Local support was provided by the Herculaneum Centre.

The Getty Foundation

PUBLISHED WITH THE ASSISTANCE OF THE GETTY FOUNDATION.

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Foreword

CHRISTOPHER SMITH
Director, British School at Rome

The British School at Rome's long-term commitment to the Vesuvian area evolved from research to conservation and management, in particular thanks to being partner in both the Herculaneum Conservation Project and the Herculaneum Centre. This all depended on the generous support of the Packard Humanities Institute, for which we are extremely grateful.

As a result of this involvement in Herculaneum, the British School, mirroring its core business as a leading research institute for the humanities, helped to consolidate a network of national and international partners around the Vesuvian archaeological sites and was able – through initiatives such as the Shelters symposium – to facilitate dialogue on approaches to heritage and its role in the 21st century.

We wish to express our gratitude to the Getty Foundation for funding both event and publication; to our MOSAIKON partners (the Getty Conservation Institute, the Getty Foundation, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and the International Committee for the Conservation of Mosaics (ICCM)) for collaborating on this event; to the Soprintendenza Pompei for giving their patronage and providing both site access and technical support; to the Herculaneum Conservation Project and Herculaneum Centre teams for their intellectual contribution to structuring the symposium and offering the logistical support which supported the event; to the 30 individuals representing the project partners and the ten Mediterranean heritage authorities who made the symposium and this publication a success.

This experience demonstrates the important contribution which the foreign academies in Rome and elsewhere in the Mediterranean can bring through their networks and capacity-building agenda to advancing approaches in the field of conservation and heritage, and is part of the British School at Rome's continuing commitment to this field of research.

I am delighted to welcome this important publication, in the knowledge that it will have a wide and positive impact on mosaic conservation across the Mediterranean and beyond.

Foreword

MASSIMO OSANNA
Director General, Soprintendenza Pompei

The true form of the city is in this rise and fall of roofs, old tiles and new, curved and flat, slender or squat chimneys, arbors of reed matting...

Italo Calvino, *Mr Palomar*

The contents of this publication are of great importance for those working for the protection, conservation and management of heritage. The sites on the Bay of Naples, uncovered from the ash and lapilli of Mount Vesuvius' AD 79 eruption have been enjoying a second life since their discovery in the early eighteenth century, and are today places full of research activity and experimentation.

Dramatic historic events have deprived the ancient Roman buildings of their roofs and it could be said that they were left without any real form. Reroofing these spaces means protecting delicate decorative features that have survived but also reinstating them as interiors, thereby giving form back to the ancient city and to its architecture. Never a neutral task, we must always be aware of the need to ground such work in a deep understanding of its context.

The devastating impact of the Vesuvian eruption and the way the whole area has evolved in both ancient and modern times has left such a rich and complex inheritance that Pompeii, Herculaneum and the other sites on the Bay of Naples are unique places where many of the challenges that are being faced by archaeological sites across the Mediterranean can be addressed. These sites have such a long history of training and knowledge transfer – from the Pompeii Archaeological School, which Giuseppe Fiorelli founded shortly after Italy was unified, to the Herculaneum Conservation Project launched in 2001 – that today these ancient spaces can be considered genuine open-air classrooms.

The Soprintendenza Pompei and the Herculaneum Conservation Project gave their support to this symposium with the intention of reinforcing the network of Mediterranean heritage institutions and professionals, so as to encourage exchange among those working in the field and ensure that shared challenges are addressed with appropriate knowledge that builds on a range of international experiences.

The multidisciplinary contribution to this symposium of both the Soprintendenza's staff and of the Herculaneum Conservation Project team is another confirmation of how this extraordinary collaborative experience has influenced approaches to the conservation and management of Herculaneum and of cultural heritage in general. It has continually emphasized the importance of experience on the ground and trials and experimentation, making research and professional debate the basis for proceeding with a correct approach to the conservation, maintenance and, as in the case of this volume, the necessary provision of protective shelters.

Preface

JEANNE MARIE TEUTONICO
Associate Director, Getty Conservation Institute

The Mediterranean possesses an extraordinarily rich and varied mosaic heritage, including a vast number of pavements from classical antiquity. Some of these mosaics remain *in situ* on archaeological sites, while many have been lifted and are presently in museums and storage. In recent decades there have been increased national and international efforts to create better conditions for the conservation of the Mediterranean's mosaic heritage. However, in the absence of a coordinated strategic approach to the problem, needs still exceed resources and important mosaics continue to deteriorate at a rapid rate.

In an attempt to address this situation, the Getty Conservation Institute joined forces with the Getty Foundation, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), and the International Committee for the Conservation of Mosaics (ICCM) in 2008 to create MOSAIKON, a collaborative regional initiative dedicated to improving the conservation, presentation and management of archaeological mosaics in the southern and eastern Mediterranean.

Through a series of interrelated activities, MOSAIKON aims to: improve the knowledge and skills of those who care for mosaics through training at various levels; develop sustainable conservation practices through the use of locally available and affordable conservation materials and methods; strengthen the network of professionals concerned with the conservation, maintenance, and management of mosaics; and promote the dissemination and exchange of information.

A number of MOSAIKON activities have dealt with the issue of shelters for mosaics and archaeological sites in general, but it was clear that the topic needed a broader conversation and forum for exchange. Shelters have been employed since the nineteenth century as a means to protect and display archaeological sites. They have often been viewed as a relatively easy way to conserve archaeological remains while leaving them accessible to visitors. In recent years, with increased emphasis on preventive conservation, shelters have also been promoted as a more benign form of protection that mitigates the need for direct physical intervention on the artefact and repeated remedial action in the future.

However, sheltering is a complex undertaking that has great implications for the conservation, presentation, interpretation, and overall management of a site. Although sometimes helpful at arresting decay, shelters have also created new problems or exacerbated existing ones, often resulting in the increased degradation of the object or structure they are meant to protect. And in all cases, the construction of a shelter (be it a simple structure or an elaborate architectural design) dramatically alters the visual landscape of a site and influences the interpretation of the archaeological remains. Too often, in fact, the shelter becomes the main event and an object of attention in its own right, rather than simply fulfilling a protective purpose.

In many ways the problem lies in the way that decisions are made. Too often, the construction of a shelter is seen as a singular and isolated activity rather than part of an overall conservation and management plan for a site. Any decision to construct a new shelter (or to alter, replace or remove an existing one) must be considered as part of a long-term strategy for a site that begins with an understanding of significance, a thorough documentation of condition and an

analysis of threats and principal causes of decay. It is also critical to assess the management environment of the site (staffing, funding and infrastructure) as well as the larger social and economic context, including the needs of local stakeholders and the demands of tourism. With such facts in hand, sheltering can then be considered carefully alongside other types of intervention including preventive conservation approaches such as reburial. Throughout the process it is also important to remember that the decision to shelter is not a final solution but rather a long-term commitment. Monitoring and evaluation must take place throughout the life of a shelter to make sure that it is fulfilling its protective function, and provision must be made for the inevitable maintenance of the structure.

In order to tackle some of these issues and to foster further dialogue regarding shelters on archaeological sites, MOSAIKON partnered with the British School at Rome and the Herculaneum Conservation Project to develop an international symposium on the topic in September 2013. Held at the site of Herculaneum, which provided something of a practical laboratory for the event, the week-long symposium included heritage professionals from thirteen countries around the southern and eastern Mediterranean as well as a group of international colleagues with relevant expertise regarding shelters. The participants represented a cross-section of disciplines including conservation, archaeology, architecture and engineering, and a range of experiences in the conservation and management of archaeological sites with mosaics.

The symposium was organized around four major themes: deciding to shelter; condition assessment and environmental issues; designing and implementing shelters; and evaluation and maintenance. After a plenary presentation on each issue participants presented relevant case studies from their countries, which tied the discussion to real sites and challenges.

The group also engaged in practical work over several days to develop a conservation proposal for an area of Herculaneum that is currently protected by a temporary shelter but requires a more permanent solution. By working together to develop an effective and integrated approach to a complex problem the participants explored alternative ways of thinking and left with new ideas that will undoubtedly benefit their own sites. Moreover, they have become a community of practice and part of the MOSAIKON network of professionals that rely on each other for advice and support.

It is hoped that this symposium and the resulting publication will further the discourse regarding protective shelters for archaeological sites and offer heritage practitioners some guiding principles when faced with sheltering decisions. Ultimately, the aim of MOSAIKON and our partners in this endeavour is to promote improved standards of conservation practice that will ensure a better future for our shared archaeological heritage.

Zaki Aslan, Sarah Court,
Paola Pesaresi, Jane Thompson

Introduction

Sheltering the Mediterranean's archaeological heritage

At the beginning of the 21st century the international conservation community gathered in the USA to take stock of the state of play with regard to protective shelters for archaeological sites, to learn from a century-long tradition of shelter building and draw conclusions that could be used at unsheltered archaeological sites.[1] On the other side of the world, conservation specialists wanting to assess conditions in a large Roman house in Herculaneum, Italy, could not safely access the building due to the risks presented by the corroded and cracked reinforced concrete beams supporting the modern roofs. Yet remedial work on the roof could not take place without first making safe the damaged mosaic floor, on which scaffolding would need to rest (Thompson 2008). At around the same time, an assessment of over 100 mosaics under protective shelters within Israeli archaeological sites revealed that more than half those mosaics were deteriorating, with many being entirely removed and other conservation approaches adopted (Neguer and Alef 2008).

It was this context of ongoing connections and contrasts between conservation theory and site management practice, together with the continuing challenge of sheltering archaeological sites, that led to the Symposium on Protective Shelters for Archaeological Sites, held a decade later in 2013 and with a specific focus on the Mediterranean region.

This introductory chapter aims to capture, within the structure that the 2013 event followed, key insights from each case study brought to the symposium, many of which emerged as their authors later reflected on the issues raised on return to their specific sites and further updated their papers. Indeed, this volume has become something more than just the proceedings of the symposium, offering considerations matured over a greater period of time and through extended peer exchange – something that has been at the heart of the MOSAIKON Programme[2] since it began but also at the core of the approaches of the Herculaneum Conservation Project[3] which hosted the symposium. It is hoped that the insights that emerge from this introductory overview, from the papers themselves that follow and from the brief notes of the closing discussion session of the symposium will, between them, offer pointers for heritage practitioners in the field to approach sheltering at archaeological sites in a way that builds on progress to date and enhances future practice in the sector.

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1 Protective Shelters for Archaeological Sites in the Southwest USA, a colloquium held at Tumacacori, Arizona, 9–12 January 2001; for more information see Avrami *et al.* (2002).

2 MOSAIKON is a collaborative, regional initiative dedicated to improving the conservation, presentation and management of mosaics in the southern and eastern Mediterranean region. The initiative is a partnership of the Getty Conservation Institute, the Getty Foundation, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), and the International Committee for the Conservation of Mosaics (ICCM).

3 The Herculaneum Conservation Project is an initiative of the Packard Humanities Institute (and its Italian arm, the Istituto Packard per i Beni Culturali) in collaboration with the Italian heritage authorities (currently the Parco Archeologico di Ercolano but until 2016 the Soprintendenza Pompei). A third partner – the British School at Rome – was also involved from 2004 to 2014, the period in which the symposium took place.

Archaeological sites in the Mediterranean region

The 2013 symposium brought together a group of practitioners working at archaeological sites in ten different Mediterranean countries, some from places with the longest history of sheltering archaeology, some from countries with no tradition of sheltering sites. They came together to review the current situation across the region together with representatives of international conservation organizations. It was an opportunity to bring solid field experience to bear on outstanding issues related to the practice of sheltering and to examine the challenges facing practitioners around the Mediterranean when evaluating sheltering as an option in protecting and managing the region's sites.

The archaeological sites of the Mediterranean region are, of course, as diverse as their specific histories and the particular social, economic and environmental contexts in which they are located. All the same, the symposium underlined how much there is in common across the region. Among the shared factors influencing heritage management and conservation practice that emerged were characteristics that regarded the sites themselves:

- archaeological heritage, often with common ground in terms of archaeological period and cultural values, and in terms of historic period and context of their discovery, excavation and study;
- large open-air archaeological sites, often with low-standing structures that make the creation of stable and controllable microclimates difficult and the introduction of shelters a major change within the site;
- archaeological sites located in open landscapes or other topography, or of an architecturally imposing nature, that allows them to be viewed from above or from a distance, which makes the introduction of shelters a major change when viewed from outside the site.

Some shared management and conservation approaches at a national and a site level also figured:

- archaeological sites owned and managed by public authorities;
- similarities between heritage management systems in terms of strengths and weaknesses;
- an increasing tendency to commission expertise and conservation works externally (in some cases even maintenance);
- conservation approaches based on protecting the material fabric and not on the significance of the site and its heritage values;
- active decay of archaeological fabric, making site maintenance a burden in terms of financial and/or human resources.

Characteristics of the entire region also shaped, to some extent, heritage management and conservation approaches:

- climatic tendencies and similarities;
- natural disaster risks, including seismic and geohydrological threats;
- political and economic uncertainty and institutional changes.

The long tradition of archaeological excavation campaigns in the Mediterranean probably saw its peak in the twentieth century. The legacy has been a proliferation of archaeological sites but also of reconstruction and protection approaches, each case very much a product of its time. There are cases when no such measures were employed. There are many more where a site's entire identity today has been defined by the restoration theory in vogue at the time of excavation (locally or from afar in the case of foreign-led missions) often paired with reactive decision-making based on resources available.

The slowdown in large-scale excavation campaigns in recent decades has, unfortunately, not been accompanied by a similar reduction in the problems that they have caused. Indeed, quite the opposite is true. As time has passed, it has become ever clearer how many conservation problems in these archaeological sites have been caused or worsened by modern elements introduced to rebuild, sustain and protect them.

As major excavation campaigns ended, all too often the communities that lived around and within the sites, who had often played an important role in their discovery or early custodianship as well as excavation, restoration and visitation, were forced to distance themselves from these places now transformed into empty ruins. The almost sacred treatment of ancient sites by heritage specialists and institutions exacerbated the problem, impeding the vast majority of archaeological sites from regaining vitality, from reaching out to communities and new forms of use, and enhancing and acquiring cultural values in the process (Wijesuriya 2017). A management focus specifically on protection and conservation on the one hand and a growing tourist industry on the other, the latter concentrating on an exploitation of the archaeological 'attractions', has further contributed to the marginalization of these sites, which are well-trodden but little understood and ever more difficult to preserve.

Sheltering archaeology in the Mediterranean

Many Mediterranean countries, in which this immense array of cultural heritage came to light from the eighteenth century to the present day, face challenges when working to maintain archaeological sites effectively. Often stripped of their decorative features and artefacts – long since lost to museums or private collections – and ageing fast, the complexity of caring for these exposed ruins risks making them more of a burden than an asset for the public authorities overseeing them, despite the benefits often seen to be related to the tourism sector. Reroofing them with shelters has come to be seen as one means of addressing the complex and interconnected conservation problems that these archaeological sites present. However, they struggle to prove to be genuine solutions since their deployment has, among other things, continued to neglect the specific needs of a site or overlooked the lessons that could be drawn from protection measures implemented previously. Each site and its setting raises its own preservation, presentation and access issues in relation to its cultural significance and these are sometimes competing. In-depth understanding of local site conditions (Aslan 2007), as well as the current and potential role of the heritage in sustainable development, is often lacking among architects and engineer-designers and even among in-house conservators and archaeologists. Indeed, despite the fascination that archaeological shelters have come to hold for many heritage sector specialists, and for architects and engineers in general, and even where lessons can be learned from past experiences at a number of sites (but are often overlooked) there is a tendency to start from scratch every time.

Exacerbating such difficulties further are trends in the area of financial resources. In recent years, funding to sustain routine running costs and the continuity of care and maintenance of an archaeological site has become difficult to source, both locally and internationally, whereas opportunities for one-off financing, capital investments to be consumed quickly, are multiplying. This, in certain cases, has prompted the construction of shelters but without securing the differing organizational capacities and resources that their long-term management requires.

Thus, in the face of the progressive decay of sites 'ageing' after exposure to the elements, often for over a century, a new era of roofing strategies in archaeological sites has arrived. In some cases these strategies replace previous practices. In other cases they are initial experiments that seek to create a historicized landscape and determine how visitors today perceive the ancient civilization that occupied the site. Highly technological solutions frequently occur where significant capital funding has been found. Other solutions, often with short- or medium-term lifespans and relying on locally sourced materials, can be the result of limited resources being made available or where experience of past mistakes prompts a more cautious approach. Many Mediterranean sites also still carry the scars of the wave of devastating protection measures based on iron and cement that was the result of the 1931 Athens Charter for the Restoration of Historic Monuments, which allowed modern techniques and materials to be used in restoration work (Jokilehto 1999: 284–285; Pesaresi 2017). Professionals managing these sites today can actually find themselves faced with a double challenge, until now often overlooked in the heritage sector: the removal and replacement of these twentieth-century

interventions, shelters included, can be necessary as they are not only a source of damage to the ancient fabric but also, in some cases, a potential threat to visitors given their incompatibility with seismic risk. Sadly the very countries in this region with the largest legacy from the era of archaeological discovery are those often most vulnerable to earthquakes.

In contrast with an increase in significant experiences of conservation practice in the field over the last decade, literature on the subject has not always kept pace. Heritage specialists struggle to build common ground around key knowledge areas, of which archaeological shelters is one. At the same time, the benefits emerging in those cases where interdisciplinary approaches and peer learning were taking place in the Mediterranean were not being measured and hence their potentially significant contributions to understanding what constitutes effective archaeological heritage management and conservation was being lost. The 2013 symposium departed from this premise and aimed to tap into the know-how of practitioners from across the region as a springboard for discussion and peer learning. This publication then offered these practitioners the opportunity to reflect on their professional experiences in the light of the symposium and develop insights for moving their practice forward. The following sections outline their contributions, respecting the structure of the original event and showing how each practitioner's case study fitted into the broader debate.

Deciding to shelter: values and the management context

A protective shelter is directly affected by the management environment in which it is created and, in turn, impacts on the heritage and other values of the context into which it is inserted. These values and management themes are explored in more depth by **Thompson and Ben Abed**.

Funding availability, intellectual and human resources for its planning and construction, maintenance and other issues are all dependent on the management system that exists for the protection and conservation of the heritage being sheltered. There are many factors that can compromise heritage processes and their results, from an unclear mandate to a lack of staff continuity, to an absence of institutional commitment to quality and performance, and so on. Sheltering and related conservation activities, such as water management, ensuring access for site maintenance, etc., are at risk of being greatly affected by such difficulties.

In some cases, the decision to shelter a site is a political one. It may be taken in order to attract new funding or because special resources are offered for a particular shelter project. However, as Rizzi puts it: 'the first rule of good shelter design is to think twice before deciding to go for it'. This is an important consideration at places such as **Chellah** in **Morocco** where, as **Chergui** describes, there are currently no shelters within the site and therefore any new modern elements will necessarily have a huge impact. As many of the authors in this volume illustrate, it is essential that the management system is sufficiently prepared for the additional work created by a new shelter and that the heritage sector works towards management models that are driven by site needs. **Erder** provides a brief overview of **Arycanda** in **Turkey**, where several modest shelters, constructed with locally available materials, have been installed to protect mosaics. Additional shelters are currently being considered for other exposed mosaics, all with the intention of reducing the maintenance needs of the mosaics. In another chapter, **Yasmine** discusses the situation at **Tyre**, **Lebanon**, where a first shelter had been implemented within a conservation project for the Monumental Tomb. This shelter was a pilot project for Lebanon, where nothing similar had been erected before, and aimed to resolve conservation problems caused by water infiltration. Planning had to take into consideration the precedent that this shelter, a significant visual impact, was creating should other funerary monuments be sheltered in the future, not only in terms of the relationship of this single element of the site with the rest of the archaeological remains but also the needs of the wider setting of a modern town.

One particular management issue that is being faced across the Mediterranean region is that of human and intellectual resources, as many traditional management systems are undergoing significant shifts in how activities at sites are carried out. For example, intellectual resources are often sourced from outside the area or even the country. For a number of different reasons these specialists brought in to resolve a single problem do not always engage sufficiently or for enough time with those working at the site all year round and other local stakeholders, sometimes leading to a failure to:

- address the specific problems in a holistic way, in the context of the entire site;
- recognize that some 'best practices' for heritage processes – or the accurateness and the length of the processes themselves – promoted at an international level are not always easily applicable, realistic or, in some cases, suitable;
- ensure sufficient engagement of local communities and other stakeholders in decisions which impact on views of the site and its cultural values.

Egyptian practitioner **El Habashi** provides an interesting example from a traditional market in **Muharraq** in **Bahrain**. The building in which the archaeological remains and their protective shelters are incorporated is in private ownership and is still in use today. He discusses the sustainability of the current solution, which is dependent on the cooperation of private individuals for shelter maintenance. Answers should be first sought internally (by the staff, local specialists, etc.) before outsourcing skills to external specialists, to ensure the long-term local host organization and stakeholders orientate and direct external input rather than being subjected to it passively. This then requires capacity building for in-house staff in the form of mentoring, network building, training, etc. In addition, steps such as framing external appointments better and developing new approaches to condition assessments can empower the organization in hosting external expertise.

It is also, perhaps, time to revisit the idea of the construction of shelters as an extremely specialized sector, and shift perception towards seeing it as a protection process to which many heritage specialists and non-specialists can contribute. Architects, in particular, play a key role in designing shelters and need to be adequately trained in conservation to understand better the specific issues related to working with archaeology and historic structures. Additionally, staff in management positions often come from disciplines such as archaeology and need additional training in project and change management in order to carry out their roles effectively. **Solomidou-Ieronymidou**, **Kaldeli and Charalambous** discuss efforts to protect the archaeological site of **Kato Pafos**, **Cyprus**. They analyse the lengthy planning process undertaken by the Department of Antiquities, which provided an opportunity for department staff to gain experience of all aspects of the shelter design process, including greater understanding of site significance and the management context.

Experience from the field shows that, in some cases, shelters have been installed at archaeological sites without due consideration of their specific management context. Better understanding of management systems, recognizing shortcomings and introducing remedial measures in management creates the best environment for sheltering. Improvements promote continuity, coherent decision-making, and cyclical and inclusive heritage processes – even within problematic management systems and/or in times of institutional instability. An effective management system provides the best setting in which to identify a site's preservation, presentation and long-term management needs and evaluate the appropriateness of additional expenditure on a particular shelter. Working towards a management system that is suited to the economic, political and institutional context and embraces broader participation creates a more positive environment for better protecting heritage.

Condition assessments and environmental issues

Specialist investigation for a condition assessment can be very important but often a systematic observation of the site by those working there is a sufficient basis for understanding the principal environmental issues, an approach that is light on both human and financial resources.

Curteis' chapter aims to provide an overview of such issues that can support in-house staff taking such an approach. He stresses the importance of performance over other design criteria and outlines the assessment process that needs to take place to ensure that an appropriate site-specific solution is found. He underlines that most environmental assessments can be undertaken visually or with a minimal use of technology, allowing more intelligent planning for shelters to be carried out even when available resources are limited.

One of the key issues that emerged from the symposium was that thinking has to take place on a broad scale, meaning that any element that merits conservation also needs to be viewed within the larger context of the archaeological site and not in isolation. For this reason, wherever possible, at least a portion of any condition assessment should be at the scale of the entire site. Furthermore, any attention given to planning and implementing a shelter should be matched by an equivalent level of attention to conservation works in its immediate surroundings, e.g. rainwater collection and disposal, nearby shelters, wall repairs, protection of wall crests, etc. These are simple and low-cost interventions, often easy to standardize, which substantially increase the impact of additional protective infrastructure and reduce damage that its introduction might cause to other features of the site. **Atki** summarizes the situation at **Volubilis** in **Morocco**, where the main conservation issues being faced are related to rainwater and vegetation management. The former problem has led to shelters being built over two archaeological structures – the Islamic Bath and an oil mill – as part of broader conservation efforts.

Protective shelters need to be constructed within a framework that takes into consideration existing conditions, including decay, and monitors them over time, so that these specific decay mechanisms are mitigated as much as possible by a well-informed shelter design. The environmental survey and monitoring must not be carried out in isolation but as an integrated part of the investigation and conservation process – and then continued after the installation of the shelter to monitor the altered conditions. Essential environmental monitoring can be carried out without large numbers of specialists and expensive equipment. As Curteis points out, it is much more important to decide what are the appropriate parameters to assess and monitor – all too often it is the easiest parameters to measure that are recorded, rather than those that will best inform the shelter design. In these cases, there is no one standard recipe for every site as the level of investigation needs to be in proportion to the site's stability/vulnerability, significance and available resources. The data being gathered also needs to be selected on the basis of those who need to be involved in interpreting the data – after all, raw data in itself is not information. Rather, the various figures involved in data interpretation and who then act on it are a key element of the sheltering process: a cohesive project design team cannot be just an architect, for example, working in isolation, it needs a scientist, conservator, architect, engineer, archaeologist, water specialist and others contributing together to find an appropriate shelter solution. In the 21st century, one of the important lessons for site staff to learn is not how to fulfill all these roles but how to outsource such work to external consultants, to brief them effectively and ensure that they deliver meaningful results for the site.

In the light of such discussions **Neguer** describes work carried out at the national park of **Bet She'an**, **Israel**, where the archaeological area includes over 10,000 m^2 of mosaics across this extensive site. The sheer scale of the place and the range of archaeological materials exposed to extreme changes in temperature has created ongoing conservation issues. As part of wider conservation efforts eight protective shelters have been erected and are regularly monitored to understand their ongoing performance.

Designing and implementing shelters: the architectural response

Rizzi offers a personal perspective on designing protective shelters at archaeological sites around the world. He begins by clearly stating his position that sites are usually better off without shelters, providing examples of the problems that can be created or exacerbated by

the installation of a shelter. The case studies offered require reflection: in some places there might be an alternative to a shelter (the Great Saint Bernard Pass in the Alps and Kaminaljuiu in Guatemala City), whereas in other cases a shelter seems to be an unavoidable solution (Herculaneum and Piazza Armerina in Italy and Copàn in Honduras). Rizzi makes a valuable point that conservationists might need to think more laterally: sometimes the client may think a situation requires a shelter when reburial or other solutions might be more appropriate.

The design and implementation of any new protective measures need, first and foremost, to ensure that they meet the site's needs but also that they are within the operational and financial capacity of the management system of the site for the entire lifecycle of the new shelter and beyond. The design phase is the last opportunity for long-term management constraints and management strengths, so often overlooked when capital funding is made available for a shelter, to be considered honestly and for planning choices to be determined. Those leading the design process must capture contributions from multiple sources and build consensus. **Ha'obsh** illustrates the complexities of the design process when describing the iterative stages of shelter design for **Um er-Rasas** in **Jordan**. Of particular note at the site are the Byzantine churches decorated with very significant mosaic floors, one of which was used as a criterion for the site being listed as World Heritage. A new shelter was built in 2009 over Saint Stephen's Church and part of the Church of Bishop Sergius to replace an older one. The author describes the design process that took place over several years to arrive at the final solution that addresses site-specific needs.

Planning and implementing shelters, like any project introducing change within a status quo, requires key factors to be balanced: scope, time, cost and performance. It is unlikely that targets for all of these factors will be met within a project and it is best to identify in the planning stage which of them may be sacrificed in the case of unforeseen problems. For example, costs often increase in the implementation phase (drainage proves more complicated than anticipated or there has been a rise in costs of a core raw material for the shelter). Something then has to give. Driven by a common desire not to see the size of the shelter reduced (scope), delivery dates delayed (time) or the quality specification of the shelter reduced (performance) and given the requirements of the heritage authority to fulfil its protection mandate and obligations to funding bodies, budget problems can arise, which often lead to funds that had been assigned to long-term monitoring and evaluation activities being diverted elsewhere on the project. Instead, agreeing with funding bodies prior to the implementation phase where budget modifications need to be introduced can ensure, for example, that a time extension for delivery of the project can be put in place in order to reduce costs.

Conservationists also need to think pragmatically: some design choices and criteria popular outside of the archaeological heritage field do not work. The idea that glass and Plexiglas are 'invisible' materials in a landscape of masonry and other historic materials is an illusion. However, should shelters at times be a way of evoking or reinforcing cultural values rather than simply seeking neutral solutions? In this context, **Chaouali and Rhouma** provide an interesting description of the process underway at the archaeological site of **Bulla Regia** in **Tunisia**, where the first protective shelter is being planned. In acknowledging management and conservation challenges faced by site staff, the authors note that only two other sites in Tunisia have shelters and that, therefore, experimentation at Bulla Regia is of great significance for future approaches across the country.

Unfortunately, many conservation problems require action to be taken swiftly and therefore adequate time for the investigation, monitoring, evaluation and experimentation that is desirable to inform planning may not always be available. This can create a need for a phased approach and/or more attention to developing good provisional solutions. Provisional structures need to respond appropriately to the level of urgency of a conservation scenario without doing damage. The erection of shelters is an activity that can be achieved quickly, even often during new excavation. However, it is all too easy to fail to consider the limited lifespans of most rapidly adopted solutions and to pay little heed to the possible repercussions of these measures. There is a need to rethink the concept of 'provisional' to respond sufficiently to

protection needs and also manage upfront the conservation demands of the actual structure created and its impact on visitors. **Pesaresi and Massari** provide examples of provisional shelters that have been trialled at **Herculaneum**, **Italy**, which were specifically designed to address immediate conservation issues but to last longer than 'temporary' shelters, thereby reducing the additional risk that temporary shelters can cause to archaeology when left *in situ* too long. They contrast these with other shelter typologies at the site, in particular, early twentieth-century reconstructions that used the original Roman floor slabs or roofs as protective shelters.

Evaluation and maintenance

Pesaresi and Stewart discuss the approaches that can be taken to evaluate shelters that are already in place at an archaeological site. As many sites already have existing protective elements installed it is important to monitor their performance and guarantee their maintenance over time. The authors offer pragmatic guidance as to the tasks that might need to be performed by site staff in order to ensure that this happens. The authors illustrate their points with cases from around the Mediterranean and beyond.

The chapter contributed by **Alef** underlines the point that ongoing evaluation is of great importance even after the shelter is installed. Her case study summarizes research carried out to evaluate the effectiveness of protective shelters at **Caesarea**, **Israel**. Four shelters had been constructed over nineteen mosaics within this national park, covering an area of 810 m^2. Yet analysis showed that the marine environment created particular conditions underneath the shelters that increased deterioration of the mosaics, with uncovered mosaics generally found to be in better condition. When shelter maintenance proved problematic, three of the four shelters were removed.

Greater attention needs to be given to the performance, lifespan and maintenance needs of protective shelters and their adaptability for future modifications. The life of a shelter can be enhanced by sourcing durable materials, guaranteeing programmed maintenance and monitoring that can identify the need for improvements to the design: capital investment followed by modest but frequent expenditure can secure a much greater result. A shelter should be designed on the basis of the maintenance that will take place. If maintenance cannot be guaranteed, it should be considered whether reburial or no shelter at all is a better option.

In addition, the evaluation of shelters needs to start immediately after their installation to avoid those cases where the conservation conditions deteriorate after a shelter has been created. Monitoring and evaluation are vital to understand the efficacy of shelters and other protective measures once in place. Often small, localized modifications can increase efficacy. **Bellibaş** critically evaluates the large shelter constructed over the Terrace Houses at the ancient city of **Ephesus**, **Turkey**. This shelter, finished in 2000, is generally considered to be effective, creating a suitable climate for visitors and the archaeology, as well as allowing conservation work to be carried out throughout the year. However, the author highlights a number of technical issues related to the shelter's performance that could be improved, as well as raising concerns about such large investment in a single project, rather than taking a more holistic approach to the conservation of the entire site.

By contrast **El-Turki** describes the large **Villa Silin**, a luxurious ancient villa that gave onto the sea at **Leptis Magna**, **Libya**. A brick and asbestos shelter at the site has become a conservation problem in itself, in addition to the health risks associated with the materials used it now leaks water onto the mosaic floor and down wall paintings and plasters. Proposals are now being examined to remove the shelter and find an alternative solution.

In the case of shelters on archaeological sites there are those that have taken on their own historical values and cannot be easily substituted. Analysis needs to take place to understand how to adapt them in such a way that they become more effective. The chapter by **Tabone and De Nigris** provides an overview of the long history of shelters at **Pompeii**, **Italy**, which has been excavated and protected for over 250 years. This means that this archaeological site has a full range of shelter typologies that reflect the period in which they were erected. In addition, the authors provide the latest examples of shelters that have been installed at the site as part of the more recent European-funded Great Pompeii Project (*Grande Progetto Pompei*).

Finally, guaranteeing the long-term preservation of a site might benefit from taking into consideration local stakeholders, who are often an underused resource in site management. Capacity building to harness more heritage benefits for local stakeholders can secure, in turn, new forms of support for programmed maintenance, etc. **Karam** offers the example of **Tell Arqa** archaeological site in **Lebanon**, where Bronze Age mud-brick structures require continual conservation and maintenance. Seasonal shelters covering an area of 1,500 m^2 – constructed and repaired by local workers – are erected annually to protect the structures from bad weather in the winter.

Conclusions

The fruit of the debate among a group of practitioners who could talk with authority about the reality of working within their own heritage management system is offered in this publication in two different ways. The Considerations at the end record the themes that emerged from the final discussion session of the symposium and, interestingly, echo many of the recommendations of the 2001 colloquium (Teutonico 2002). This surely confirms the need for practice in the field to change to reflect what practitioners already know: that decision-makers need to consider a range of options for site protection, not just shelters; that long-term care need not be high-tech but needs to be consistent over time; and that shelters lacking proper attention cause more problems than they solve and should not be installed. It also confirms that the symposium met a need for Mediterranean practitioners to convene and reach consensus about existing approaches in their region and beyond, before looking to the future.

At the time of publication, however, it is reassuring to see some of these considerations filtering down to site level and being put into practice, and these emerge within many of this volume's case studies where the participants of the symposium continue to share their experiences and report on the impact of the symposium. For example, Rhouma and Chaouali are more informed and proactive 'clients' for a shelter commission at Bulla Regia; Yasmine, as he reports in an addendum to his chapter, was able to insert additional monitoring to the shelter planning process at Tyre; Tabone took the symposium approaches to the intense experience of the Great Pompeii Project; while El Habashi expressed his intention to change the teaching of his architecture students so that the curriculum would reflect the realities of conservation practice in the field. It is hoped that the wealth of the experiences presented here in this volume, of sharing practice across the Mediterranean region, will also provoke and inspire changed approaches to archaeological site protection among its readers.

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Part 1
The process of sheltering


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Deciding to shelter: values and the management context

This chapter introduces the implications of shelters in archaeological sites by looking at a series of case studies from the perspective of 1) heritage values and 2) management capacity. Only by recognizing the cultural and natural significance of a place – in terms of heritage values, and in terms of who holds these values and the attributes that convey them – can decisions be made about what to protect and the impact a shelter will have. Only by understanding the management context can it be judged whether a shelter will constitute a benefit or a problem. These are just two of a number of aspects that are included in an approach to sheltering as a 'process'. The others are explored in later chapters of this volume.

Questions around heritage values and management capacity are all the more important when working with archaeological sites in the Mediterranean area, where many countries have no tradition of erecting or maintaining archaeological shelters for many reasons. There is often a lack of awareness among heritage practitioners around the importance of sheltering as a tool for conserving archaeological sites but there may also be entrenched misgivings regarding the introduction of new structures. This is a region of the world where archaeological sites continue to be predominately owned and managed by public authorities. For the public institutions and the individual heritage officers the responsibility of overseeing heritage values and management concerns may seem daunting or, in some cases, a luxury given the large burden of administrative procedures that offer no scope for improving conservation and management effectiveness. In reality, values and site management are areas where local consultation and local knowledge (including local heritage professionals) are often to be considered more important than external expertise. This can be at odds with the need for outsourcing specialist skills to address some of the technical challenges faced when designing shelters. Knowledge from local staff and communities and from external specialists has to come together for a successful approach to sheltering. It cannot be an entirely outsourced process.

Insights into the types of change a heritage place can accommodate without compromising cultural significance are present within the sites and among the communities involved in them. Insights into what level of change the management environment can and cannot sustain are available by studying the heritage management system. The individual heritage officer perhaps needs to capture these insights better through listening and observation in order to become a 'client' who is effective in commissioning external parties to design and build shelters, to be a manager who is effective in instructing in-house staff to erect or manage shelters, and/or to be a mediator who is effective in renegotiating funding opportunities differently if sheltering is not the right solution.

Understanding and defining these values and management realities for each specific heritage place depends on building up a common language and drawing on common decision-making frameworks; these are often already in place to some degree and the consolidation and use of them does not require dramatic management reform. The process can be a

stimulus for greater transparency and, in turn, greater stakeholder engagement, which is particularly significant at a local level. This can improve the heritage sector's ability to address *all* factors – not just technical ones – when and if the decision to introduce protective shelters is taken. In this way, it will be possible to overcome the problematic notion that 'any shelter is better than no shelter' (Agnew 2002: 15) and avoid repeating more detrimental sheltering choices.

Heritage values

Possibly the most substantial development since the publication of the special edition of the journal *Conservation and Management of Archaeological Sites* dedicated to protective shelters in 2002 is the greater acceptance of a more sophisticated approach to understanding 'what we actually have' in heritage terms (Matero 2002). For example, structured analysis of heritage values, together with the concepts of integrity and authenticity, has become the backbone of the entire World Heritage system, being used in the nomination process, for routine management and for evaluating the impact of change on heritage (UNESCO 2016; Wijesuriya, Thompson and Young 2013; ICOMOS 2011). A values-based approach is gradually influencing practice in many realities in the field and even, in some cases, legal and institutional frameworks at a national level.[1]

The recognition that the cultural significance of heritage is a collection of values held by multiple individuals and groups, rather than some intrinsic value that only an expert can identify, is a significant step forward for decision-making regarding changes to heritage places (Demas 2000). This extends to the introduction of new protective measures like roofing.

In the following paragraphs, the sheer diversity of scenarios in the field is mapped as a means to illustrate some of the broader questions to be addressed before, and in parallel with, debate around the conservation requirements of specific physical attributes of a site and exploration of the potential technical benefits of sheltering. By managing to define what actually matters, and to whom, we can leave behind fruitless debates around form over function: deciding how to shelter according to a 'hierarchy of proprieties'; or the 'effectiveness' of protection coming before 'architectural statements' (Agnew 2002: 9).

Sheltering practices enhancing heritage values

There are ways in which sheltering practices can enhance heritage values. It might be the cycle of seasonal repairs and protection measures themselves that reflect specific climatic realities, echo traditional building practices in a particular region and reinforce the remoteness of the heritage place (remoteness that may well exclude other approaches); and are hence part of the cultural significance of a place. Seasonal shelters at Tell Arqa (Lebanon) are perhaps a case in point as the short-term roofing solution using local materials addresses the limited seasonal nature of climatic phenomena that affect the fragile remains of the site and avoids dependence on more elaborate, hard-to-source building materials (see Karam in this publication; Figure 1).

Values in the setting

The process of sheltering must take into consideration not just individual monuments or the site context but the entire setting. It might be that the core significance of Volubilis (Morocco) is not the impressive archaeological remains themselves (there are, after all, some similar sites) but their elevated and dramatic relationship to a vast and unspoilt landscape, one that is difficult to match in the Mediterranean and has remained nearly unchanged over 2,000 years (Figure 2). The very early introduction of urban planning in Moroccan legal frameworks (a royal decree of 1914) consolidated – perhaps also due to its early use for colonial residential districts (Radione 2016: 17) – a nationwide awareness of the implications of change in urban and rural landscapes. Already by 1920 a specific royal decree defined and established a protection zone around the ruins of Volubilis (see Atki in this publication), which has undoubtedly favoured

[1] For example, Article 69 of the Constitution of the Republic of Croatia uses the concept of heritage corresponding to values.

FIGURE 1: Short-term roofing using local materials addresses the limited seasonal nature of climatic phenomena that affect the fragile remains of Tell Arqa (Lebanon) and avoids dependence on more elaborate, hard-to-source building materials.







FIGURE 2: Localized protection measures for archaeological remains in Volubilis (Morocco) must also protect other attributes of its Outstanding Universal Value including views to and from the landscape setting (see also image on p. 12).

protection of the setting of this place, a fertile agricultural area, safeguarding the very reason why it became an important outpost of the Roman Empire.

With a landscape value that is so strong, the reference framework for deciding to shelter should not be restricted to a specific mosaic needing protection nor indeed to the boundary of the archaeological site. The basis for reasoning can shift entirely. Within a broader understanding of values there might be, for example, increased emphasis on the capacity of ground-level actions (such as good rainwater collection and disposal, intensive maintenance and even seasonal



FIGURE 3: View of a mosaic in the House of Orpheus (Volubilis, Morocco). The importance of the richly decorated room is inseparable from the fertile landscape in which the Romans decided to build this important outpost of the empire.

reburial of vulnerable features), which rival the conservation effectiveness of introducing new shelters. Sheltering, potentially, may impact more negatively on the conservation of important heritage values, in particular on the perception of Volubilis in the landscape for visitors and local communities alike (Figure 3).

Use values, past and present

The archaeological site of Bulla Regia (Tunisia) to some extent echoes the rural setting of Volubilis but it conceals a vital difference, which goes to the core of its specific significance for many visitors: the houses whose importance lies in their cool underground floors, often rich with mosaics (Figure 4). Here within there is a real invitation to extend conservation measures beyond just ground-level actions. The underground depth of the houses makes rainwater collection and its disposal from these areas problematic and, in turn, seasonal reburial difficult and potentially counterproductive. Implementing the right shelter solutions here could not only achieve greater effectiveness in the conservation of physical attributes but also potentially help visitors interpret the urban configuration of the distinctive residential district of this ancient settlement by directing attention to the dwellings that the shelter conceals. Sheltering strategies could also take into account the activities of local youths and other members of the community who already enjoy the site (Figure 4), not only offering them shade and refuge from inclement weather and summer heat but also communicating a clear message of which areas of the site are more fragile and merit different use patterns. Another factor that could influence the decision to shelter is the proximity of large modern settlements (in the case of Bulla Regia this is Jendouba), which favours the sourcing of specialized labour and materials that new shelters could require.

Attention to past use patterns as central to the significance of a place, and how that shapes access today, can also determine the quality of design solutions, sometimes perhaps even subconsciously on the part of the designers. In the case of Chan Chan (Peru), metal frame structures have been used to offer some shelter to many areas of the site; ruins of residential



FIGURE 4: Past and present use values can be captured. One of Bulla Regia's underground houses, the House of Amphitrite, where a protective shelter is planned (left). Local youths play football in the site's open grassed areas (right).



FIGURE 5: Shelters erected over the remains of residential districts (left) and over the Royal Tomb in the Tschudi Citadel (right) at the archaeological site of Chan Chan, near Trujillo in Peru.

districts made of sand and mud bricks that are particularly susceptible to rainwater erosion and other environmental factors.[2] The short intervals between structural supports have allowed limited spans and hence a lighter roof construction. The rhythm that this creates in many way echoes the dense spatial distribution of these habitations (Figure 5).

Instead, the shift at Chan Chan from a bamboo structure to a metal one for the Royal Tomb in the Tschudi Citadel decreased the intervals between supports thereby reducing the visual interruptions and allowing this place to be appreciated in its entirety, both the interior space and views to the landscape, respecting and accentuating its commemorative status (Figure 5). It is yet to be seen if the reduced ease of regular maintenance and repairs of metal over bamboo structures, in terms of local labour and supplies, will be decisive for the lifespan and effectiveness of these newer shelters.

2 The World Heritage property known as the 'Chan Chan Archaeological Zone' was inscribed on the List of World Heritage in Danger straight after its successful nomination in 1986 and has remained there for these, and other, reasons (UNESCO 2017).

Values conveyed by continuity of use or reuse

Shelter choices can facilitate use patterns that are at the heart of the cultural significance of the specific heritage and always have been. This is the case of spiritual heritage places where continuity of rituals is vital. For example, roofing repairs over the centuries, including partial or total substitution in many cases, of the remarkable Byzantine churches of the Troodos mountains (Cyprus) were motivated by the continuity of religious practices in remote areas subjected to a hard climate (Stylianou and Stylianou 1997). The roofs of these churches are often entirely modern and thus what has been essentially a form of 're-sheltering' has allowed the masonry fabric and the decorated interiors to survive in a remarkably good state of conservation (Figure 6). Moreover, the activity of re-sheltering has allowed the rural mountain communities who use the churches to continue their religious practices (Figure 7). The original fabric has at times been replaced but the important 'living' heritage values have been preserved. Repairs and upgrades to the exterior shell of these Byzantine mountain churches have generally drawn on local materials influenced by Troodos' specific geology and biodiversity. It is not the authenticity of the original fabric of the shell as much as the continuity in the approach to housing these interiors that is the attribute to be preserved.

In 2002, at the time of the special edition of *Conservation and Management of Archaeological Sites,* the focus of professional debate was still on the material fabric being the main 'resource' to protect (Agnew 2002: 8), whereas it is now being recognized that often the rituals of use and repair as attributes of spiritual significance are of greater cultural value (Wijesuriya 2005).

Another example of this phenomenon can be found in those sheltering actions driven by the urge to celebrate traces of the past above and beyond their original identity, to the extent that heritage values evolve but also coexist alongside other values. In the case of the archaeological site of Capernaum (Israel), these are religious values in the form of pilgrimage, in particular to an early house-church, said to be where Saint Peter lived (Fischer 2017: 251–253). It



FIGURE 6: The Byzantine church at Moutoullas in the Troodos mountains (Cyprus) in 1951 (left) and 1984 (below left) juxtaposed with a view of the exterior today (below right).





now has a modern structure sitting over it, which is a place of worship that pays tribute to and protects the traces of what is commemorated as the saint's home. It is an example of a modern addition going beyond mere protection, access and use of a heritage place. This addition is, above all, reinstating and amplifying a lost religious function of the area with an entirely modern structure resting on eight pillars hovering over the archaeological remains (Figure 8). It is an intervention of its time (a design of the 1980s; Custodia Terrae Sanctae 2012) and would probably be seen as intrusive if subjected to the process of today's Heritage Impact Assessments, since its presence affects views over, and understanding of, the overall ancient layout of this settlement on the Sea of Galilee. However, the high number of visitors reminds us that for some heritage typologies we must learn to reconcile spiritual significance and religious use with other values, as well as be open to an evolving significance that will contribute to the creation of the heritage of the future.



FIGURE 7: The cemetery next to the Byzantine church at Moutoullas (top) and evidence of the ongoing regular use of Lagoudhera's Byzantine church for religious rites (right).



FIGURE 8: An archaeological site at Capernaum, Israel, with the 1980s place of worship designed by Ildo Avetta hovering over what is said to have been the home of Saint Peter and the remains of a later Byzantine church.

Legibility of architectural and urban values

There are scenarios where the wider benefits (not just protection) of the new volumes created by archaeological shelters depend on a systematic urban-scale approach to their design. The legacy of twentieth-century roofing at Herculaneum (Italy), currently undergoing substantial repairs, integrations and maintenance innovation (see Pesaresi and Massari in this publication) is a testimony to this. Herculaneum can be viewed from the modern town some 20 m above the ancient remains. It is an evocative landscape of reinstated Roman roofs and floor plates, with modern shelters integrated locally when archaeological evidence was lacking. This approach lets the eye capture the urban density and form of this district of the ancient city but also perceive the most intact areas within the archaeological site. Furthermore, this systematic approach has enhanced the relationship between the ancient city and the densely developed urban districts of modern Ercolano above (Figure 9). Research is ongoing but since the 1920s the resolve to recall the domestic scale and original materials of the ancient roofing (much inspired by the wealth of archaeological evidence), rather than opt for large-span, flyover structures, also seems to create microclimates more in keeping with the environments that the masonry, wall paintings and mosaics originally enjoyed and hence favour conservation objectives.

Other sites in densely developed areas could benefit from such an approach. The archaeological areas of Tyre (Lebanon) now within the modern town of Soûr, a major urban coastal conglomeration, could be an example where a similarly limited portfolio of sheltering solutions could be utilized systematically throughout the Tyre El Bass necropolis site (Figure 10). The right solutions, which are currently being trialled, could make the quantity, quality and distribution of the mausoleums more legible (see Yasmine in this publication). They could also reintroduce intimate spaces into these archaeological landscapes, which are at times overwhelmed by the adjacent urban development.

Enhancing or reinforcing heritage (and other) values

The ability of a shelter to contribute to the understanding and enjoyment of traces of past cultures reaches perhaps its most extreme expression at the small archaeological site of Chur (Switzerland). This is a scenario where the shelter itself becomes as much an attraction as the





FIGURE 9 (above): The rebuilt roofscape of ancient Herculaneum (Italy) is a mix of reinstated ancient roofs, floor slabs and more abstract shelters where archaeological evidence was lacking. Respecting the spans of the Roman roofs rather than flyover shelters reinforces the legibility of the original urban fabric and reinforces continuity with the modern town above.

FIGURE 10 (above and right): The two main archaeological areas of Tyre (Lebanon) with the urban backdrop of Soûr lend themselves to a systematic urban-scale approach to sheltering, the repetitive mausoleums of Tyre El Bass in particular.



archaeology. The remains of three Roman buildings have been critical in informing researchers' understanding of the ancient history of this area. However, the actual physical evidence is modest, a set of foundations, and constitutes relatively illegible traces for a non-specialist.

The open-lattice frames introduced in the 1980s admit light and air and act as a protective casing. The shelter is aligned with the outer walls of the archaeological remains forming an abstract reconstruction of the Roman volumes. They give a visible form to the location of the Roman buildings in today's town landscape and accompany visitors in understanding them (Durisch 2014). Moreover they create pleasant environments in which to reflect on the past, be it from within the spaces themselves during the day or by peering in through the slatted walls at night where at a press of a button visitors can illuminate the interiors and create a glow that animates the small town. The frames have become a landmark of modern architecture, and a significant number of visitors are young designers. Indeed, the new additions have enhanced modern Chur with a contribution to architectural heritage from the twentieth century. This case study teaches us that if genuine architectural quality is achieved when shelters act as spaces to understand and celebrate the past, as much as to view and preserve it, they take on a crucial role in increasing recognition of heritage values among local communities and beyond. With consensus increased around the value of heritage (and in all the areas where capacities to conserve and manage it reside; UNESCO 2011), these traces of the past in Chur will not be forgotten.

The values paradigm shift

A values-based approach to managing change that builds, where possible, on existing management capacities helps us leave behind the adversarial, confrontational language that has predominated in the heritage sector. In the case of protective measures, it lets us abandon the defensive preconception of shelters as solely defending heritage from 'threats' (Agnew 2002: 7). Sheltering is not just protection. As a number of the authors noted in the 2002 volume of *Conservation and Management of Archaeological Sites*, sheltering is also about presenting heritage to the public (Matero 2002; Stanley-Price and Jokilehto 2002; Palumbo 2002). Today we can go further. The diversity of case studies highlights that acknowledging and analysing heritage values with a view to identifying the broader benefits of sheltering helps us capture important additional inputs into all stages of the process: the decision to shelter, then the design process, implementation and management. It is about recognizing that shelters create opportunities as much as they respond to threats. Such an approach also obliges every choice to be grounded in broad consultation and consensus built around real benefits for the site and its communities, protecting us from random aesthetic choices or sheltering for the wrong reasons.

Many national institutions and legal frameworks are still entrenched in a more conventional approach to defining heritage with a sole focus being on the archaeological fabric itself (Wijesuriya, Thompson and Young 2013: 24–28). This often means that the stronger emphasis on values has to be introduced within heritage processes at a site level and with careful sourcing of financial, human and intellectual resources. The sample checklist on the following page is aimed at helping heritage practitioners at a site level understand the context in which decisions about sheltering are being made (new shelters or revisions to existing ones) and empower them to lead the process more effectively and secure the best result for the site and its communities (Table 1).

Consideration of a variety of issues may help practitioners in the field build consensus around values-based management of continuity and change at archaeological sites.

TABLE 1: Sample checklist to establish if the institutional environment promotes decision-making that is rooted in a detailed understanding of the cultural and other values of a heritage place and of all those involved.

National-level heritage management systems often define heritage with inventories that identify monuments, historic places, landscapes, etc. • Does your country have any mechanism to define the cultural significance of these heritage places in more detail? • Does the constitution or national legislation, site-level policies, or indeed mandates established by long-term community practice, consider heritage: ■ As a set of values held by different groups? ■ As a shared responsibility?
Has the heritage system at a national level domesticated the World Heritage Convention and its procedures into national legal frameworks in any way? Whether your site is World Heritage or not, this could be a vehicle for increasing attention to defining and managing sites in terms of heritage values and their attributes.
Are there precedents for public consultation and community engagement procedures in your country for heritage or indeed in other sectors in relation to strategic planning or decision-making regarding changes to public goods?
Is data collected about: • Who is currently visiting the archaeological site and why? • Socio-economic and demographic trends in the local area around the archaeological site?
Etc.

Statement of significance

If greater attention to a values-based approach must be instigated at a site level, a statement of significance can be a useful step to begin to capture the specific importance of a heritage place (Wijesuriya, Thompson and Young 2013: 24–28; Semple Kerr 2013: 4–21). The statement of significance is essentially the summary of findings from a systematic analysis which, through a stepped process, builds knowledge in four areas:

1. Identify the diverse heritage values that make up the cultural significance of the site – values of international, national, regional and local importance;
2. Ascertain which attributes convey or express each value;
3. Ascertain the authenticity (the truthfulness of the attributes in conveying cultural values) and the integrity (the completeness and intactness) of the attributes identified;
4. Identify the individuals or groups most associated with the appreciation of specific values and/or the use or management of specific attributes.

Attributes, authenticity and integrity

Only in the last ten years has there been proper recognition in the international community[3] that attributes that convey heritage values are not limited to materials, workmanship and setting (i.e. tangible aspects of the heritage) but are part of a more complex reality that reflects the increasingly broad definition of what constitutes heritage, including intangible heritage. For the purposes of World Heritage for example, these can be grouped among a diverse range of themes including intangible qualities, and of which the following are just examples:

- Form and design
- Materials and substance
- Use and function
- Traditions, techniques and management systems
- Location and setting

[3] In 2003 the UNESCO General Conference approved the *Convention for the Safeguarding of Intangible Cultural Heritage*. Previously only national or regional charters dealt with the concept of heritage significance being conveyed by intangible attributes.

- Language and other forms of intangible heritage
- Spirit and feeling[4]

This is very significant for assessing the appropriateness of sheltering since this list echoes many of the issues raised by the case studies explored in this publication.

For archaeological sites, the attributes can take on specific importance if they:
- reflect how the place influenced or was an interchange of ideas;
- in some way manifest those ideas;
- and do so truthfully.[5]

For archaeological sites in urban areas where the site's significance is intertwined with ongoing inhabitation of the area, the attributes can include modern structures, spatial plans, traditions, living communities and the socio-environmental 'whole' of ancient remains and modern settlement working collaboratively as a single 'ecosystem'.

In recent years, increasing attention has been given to authenticity and integrity (e.g. Weiler and Gutschow 2017) to qualify and quantify attributes.[6] These are particularly important considerations to explore in the values analysis so it becomes a solid reference framework for managing change, not just continuity i.e. the case of introducing archaeological shelters where greater stability for the archaeological remains (continuity) is gained by introducing new protective roofing (change). As the case studies explored have shown, there are moments when cycles of repairs or historic restoration interventions on archaeological sites take on their own cultural values and their authenticity also needs managing. Similarly, problems of integrity – missing or compromised attributes – can often mean shelters have a more substantial role in contributing to the understanding and even the cultural significance of an archaeological site. In these cases shelters help appease the negative implications of weak attributes (buildings collapse, traditions disappear, communities cease to thrive, etc.). It is through statements of significance that also explore the authenticity and integrity of attributes that it will be easier to understand the vulnerabilities of a heritage place and weigh the importance of, for example, safeguarding the setting (e.g. landscape) over a material attribute (e.g. an archaeological structure) over traditional use patterns (e.g. rituals that take place at the site).

Building up knowledge and consensus around heritage values

A values analysis document must draw on inputs from multiple sources including:
- Information already available: institutional records (including those outside the heritage sector), research projects, excavation campaigns, etc.
- Consultation with audiences that represent all three areas where heritage capacities reside: practitioners, institutions, and communities and networks (UNESCO 2011).

If consultation has never been done, it could be an opportunity to explore different groups' perceptions of the values of the heritage place and also their views on potential changes, such as the introduction of new shelters.

The values analysis document should be updated, enriched and modified as the understanding of values, attributes and stakeholders changes over time. The document itself can become a framework for building consensus around heritage as a shared responsibility. It can form an important baseline for long-term management and decision-making regarding changes to the site (desired or undesired change).

Above and beyond the bibliographic resources for cultural heritage already noted, it is worth consulting World Heritage Centre and International Union for Conservation of

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4 UNESCO 2016: paragraph 82. The *Operational Guidelines for the Implementation of the World Heritage Convention* introduced the concept of intangible attributes through the integration of this dedicated paragraph in a 2005 revision.

5 Reconstruction might hinder this process but not always e.g. when reconstruction is part of a restoration campaign that has taken on its own cultural importance – e.g. Archaeological Areas of Pompeii, Herculaneum and Torre Annunziata (Italy), Historic Centre of Warsaw (Poland) – or when reconstruction is a consolidated tradition of cyclic repairs over centuries and an attribute in itself – e.g. Painted Churches in the Troodos Region (Cyprus).

6 The *Operational Guidelines for the Implementation of the World Heritage Convention* introduced the concept of integrity in 2005.



FIGURE 11: The archaeological shelters erected in Chur, Switzerland in 1985–86 to a design of Peter Zumthor.

Nature publications for natural heritage, which are increasingly relevant to cultural heritage management. The 2008 *Enhancing our Heritage Toolkit* (Hockings et al. 2008) is a case in point; it offers practitioners ideas on how to structure decision-making around heritage values at every stage of management processes.

The management context

It is the capacity to manage heritage places, both what is inherited and what is added, that must also be at the core of decisions made about sheltering. The 2002 edition of *Conservation and Management of Archaeological Sites* pinned down a widespread assumption that must be challenged: the tendency to see archaeological shelters as a 'response to an immediate need, as a once-only enterprise' (Agnew 2002: 15). However, it perhaps fell short in terms of understanding the full complexity of managing the repercussions of adding shelters in the long term. Talking in terms of ensuring 'enough resources for maintenance' (Agnew 2002: 8) is not enough. Nor is it enough to monitor the shelter and the area it protects before, during and after its erection (Agnew 2002: 8). Instead it is vital that the effectiveness of the entire management system is understood and checked continually to be sure there is sufficient capacity in the right areas to care for the changing pressures on management created by new additions such as shelters, or indeed by a decision not to shelter.

Once again, case studies are a means to understand the variety of issues raised. As demonstrated by the 2013 symposium, of which this publication is a result, it is the diversity of approaches illustrated by examples from the field that remind us most forcefully that we are dealing with a long-term process, not a one-off event: cyclic sheltering with seasonal roofs (Tell Arqa, Lebanon), continuity and intensity of ground-level care versus shelters (Volubilis, Morocco and Bulla Regia, Tunisia) and reburial (Kato Pafos, Cyprus) all being examples that are explored further in this volume. A glance at other case studies elsewhere helps us mark progress in the last ten years or more.

Managing others who are managing values - outsourcing

Archaeological shelters are most often pursued as a means to reduce the phenomenon of active decay of ancient remains in open-air archaeological sites, a measure which, in its most extreme version, correlates with the safety and predictability of a museum environment; that is to say greater stability, increased control and fewer management unknowns. Forms of active decay of the archaeology are radically reduced if the ability of the all-encompassing shell to maintain the right environmental conditions is maintained. It is generally easier and cheaper to maintain a modern architectural shell than fragile archaeological remains. However, this depends on ease of access to specific materials and skilled labour related to maintaining modern architecture versus traditional vernacular buildings of a certain place; skilled labour often being more readily available and better suited to the care of ancient buildings in the Mediterranean region, particularly in areas that are remote or in socio-economic difficulty.

The experience of sheltering the site of Akrotiri on the island of Santorini (Greece) offers an important contribution in this context. As Figure 12 confirms, the stability created by this exhaustive approach to sheltering, a shell enclosure completely enveloping the ruins, not only safeguards the ancient remains but creates a shaded, protected environment for visitors and those still advancing archaeological excavations.

In such an approach, the major capital investment – financial and intellectual – for the design and procurement of a major new shelter is hopefully then balanced by the demand for human and financial resources in the long term being more predictable and contained (less archaeological conservation work). The challenges of effective procurement and risk management for such an ambitious solution, with the outsourcing of both design expertise and the actual construction of the shelter, became evident during a subsequent investigation that took place into the causes of a partial collapse of the structure that occurred in 2005. With the failed shelter fully upgraded, the site reopened in 2012.

This comprehensive approach to sheltering significantly impacts on how the ruins are perceived and this needs to be weighed against the conservation and management benefits that the client and the designers of the shelter sought. The closed environment, while reminding the visitor that many of the structures were once roofed, also isolates the physical remains from their wider setting – landscapes, seascapes, skies, weather, etc. – with the risk that these ruins could be anywhere in the world. The pale colours chosen as a backdrop – floor finishes and interior walls and ceiling – were intended to place the archaeology quite rightly in centre stage. However, the effect can also be to make the ancient urban blocks appear as a series of independent objects, a museum collection, and this makes it more challenging to convey the elaborate relationships that were inherent when the place was in use in antiquity. This effect is all the more acute since, like in many Mediterranean sites, many wall paintings and finds have been removed over the years to be placed in local and national museums, thereby reducing the legibility of these urban blocks.

The sheltering strategy at Akrotiri makes a significant contribution to the field and it will be important to draw lessons from this intervention throughout its lifespan. The design outcome of the sheltering in Akrotiri that visitors enjoy today offers a significant departure point for considering future improvements that upgrade the modern complex, with the specific heritage values of the site and its setting sitting at the heart of this process.

Such a learning curve would prove particularly rewarding within a management system typical of many countries in the Mediterranean (and not only) which do not identify heritage in terms of values, but it has repercussions right throughout the management approach. The mandate is often restricted to that of defending the archaeological structures as a set of physical testimonies to the past where the material fabric has intrinsic value identified by experts. It is an approach that in the past has often failed to allow a broad capture of the multiplicity of cultural (and other) values and different individuals and groups that come together to give specific significance to a place and its traditions (Wijesuriya, Thompson and Young 2013: 24–28). The price for this oversight emerges all the more strongly when a major change, a new





FIGURE 12: Refurbishment, remodelling and replacement of the shelter at the archaeological site of Akrotiri, Santorini (1998–ongoing) for a total of 13,000 m^2 and 60,000 m^3.

archaeological shelter being one example, depends on an increasingly effective management system for its successful implementation. The absence of a values-based approach not only makes the decision-makers potentially blind to some heritage values and interest groups associated with the site. It may, in turn, reduce the margins for those responsible for the site to build consensus and build management capacity by drawing on existing and new sources of support when shortcomings emerge in a specific management area.

Working with others

The archaeological site of what was another of the ancient world's earliest and largest cities, Catalhöyük (Turkey), is another case that will also be interesting to monitor in coming years, with access to management information becoming increasingly available thanks to its recent World Heritage inscription.

The 1983 Law for the Conservation of Cultural and Natural Property in Turkey quite rightly attempts to make the foreign missions present in the country, primarily for excavation and research priorities, substantially responsible for the conservation and maintenance burden that their activities create.[7] One consequence of this laudable legislative clarification is a tendency for under-resourced state heritage authorities for archaeological sites to rely on these seasonal campaigns to deliver what in other countries would be their core business. This can lead to primary conservation and management measures happening only on a seasonal basis, with the public authority's role confined to solely that of guarding the site and limited on-site monitoring activity throughout the year.

In this case, the Çatalhöyük Research Project has acted not only as an archaeological mission but also as a framework for facilitating or inspiring international contributions from universities and non-governmental organizations on a seasonal fieldwork basis since 1993 (Çatalhöyük Research Project 2017). This has included helping to attract financial support from the Global Heritage Fund and other donors for specific broader conservation and community projects; of particular interest are the two major large-span shelters that were introduced (Figure 13; Global Heritage Fund 2017). These shelters have undoubtedly met many of their short-term objectives of facilitating new excavation and introducing public access in a safe environment in what is a highly seismic area. However, according to some of those involved, these shelters only in part met the need to improve protection of remains so vulnerable to erosion (largely unfired mud-brick) during and after conservation measures: 'These fluctuations [in relative humidity and temperature] make it very difficult to preserve the buildings (especially the burnt ones) under the micro-environment of the shelters for a protracted period of time' (Atalay *et al*. 2010: 9-10). Undoubtedly, future sheltering strategies at Çatalhöyük, modifications and additions, must build on the experience gained from these new long-term large-span shelters as well as from previous medium-term smaller-span trials over a single building using 'a double-skinned tent-like fabric shelter which provided wind protection and comparatively cool conditions' (Atalay *et al*. 2010: 9-10).

How the large-span shelters will age is of particular interest as it is evident that not only will they require cycles of routine maintenance and more substantial repairs with associated specialist materials but they could potentially benefit from design revisions to respond to the problems that are being recorded on-site. Revising existing shelters is a reality many heritage authorities increasingly need to face, as the 2013 symposium testified. Realistically, at many sites not all external partners have the mandate or resources to tackle the prospect of having to renew shelter structures over time. This prompts concerns as to whether the heritage authority will have measures in place to ensure that the long-term management system for the site will be ready to rise to these future challenges all the same.

Perhaps the outcomes of sheltering experiments will point to a shift in approaches at Çatalhöyük. The site has found many of its narratives and new audiences thanks to international partnership, local community engagement and then World Heritage status. Might the focus now shift from increasing the excavated areas to a values-based approach that evaluates the options of alternating seasonal reburial with seasonal shelters on a building-by-building basis? Might shelters be trialled that perhaps allow visitors to capture the intimacy of these extraordinary top-entry dwellings within a settlement with no streets? Some of the key figures who have shaped the recent history of Çatalhöyük have noted that the lessons at this site teach us that 'the shelter is the start of a long-term process of monitoring and conservation that must be vigilant and sustainable' and that 'It is thus clear that the various agencies involved in the management of sites such as Çatalhöyük need to envisage a long-term commitment' (Atalay *et al*. 2010: 9–10). They might well find that sheltering in this case is not the start of a process but rather the substance of the process itself, with re-sheltering becoming as accepted here as it is in Tell Arqa. The progress already made in increasing community engagement at Çatalhöyük will prove vital. More localized seasonal and cyclic protective measures might also bring to the fore the fact that local community members can contribute to more management

[7] Article 45, Law no. 2863 on the Conservation of Cultural and Natural Property, Turkey.

FIGURE 13: The earlier South Shelter (top) and the North '4040' Shelter (below) at Çatalhöyük (Turkey) conceived to facilitate excavation and ongoing conservation, as well as visitor access.





areas than just monitoring and documentation. Now the international and local communities have together laid solid foundations, the opportunity of 'going local'[8] in more areas of site management (not just in sheltering approaches) will also release the site from a vicious 'circle of interaction for funding' made up of 'the sponsors themselves, the media and the archaeology' (Atalay *et al*. 2010: 10) by building a more resilient management system for the site that is operative all year round.

[8] A term used by the UK's National Trust in strategic planning since 2009 to capture the desire to reduce bureaucracy, devolve power, increase local distinctiveness, and harness and enhance existing capacities within local communities (National Trust 2010).

Friendly aliens

In this context, it is interesting to return to the case of Volubilis (Morocco) with two very different perspectives. On one hand, there is the new long-term shelter extending over a single building unit, the Idrisid Baths, an important medieval bath complex (see Atki in this publication; Figure 14). The design revisits the traditional construction techniques and forms with different local materials, including timber. Both internally and externally, the shelter design finds its place in helping visitors read the single monument and protecting the material attributes within, while also ensuring the integrity and legibility of this area of the site without disturbing the setting beyond. Above all, its erection and long-term maintenance build on existing expertise and skilled labour involved in the management of the site.

On the other hand, an image which captures a passing moment is a reminder that the relatively conservative approach at the Idrisid Baths can be complemented by other approaches. A photograph of a visitor in red clothes in front of some of Volubilis's most imposing standing structures underlines the capacity of an archaeological site to host passing colour and change, and the potential beauty of the result (Figure 14). Even the colour of a passing visitor can enhance our perception of the ancient stone columns behind. It is a reminder that seasonal protective measures or medium-term roofing solutions can be not only more adventurous and creative in the way they enhance (not just safeguard) values but also more agile and flexible in the way they draw on the existing management system's strengths.

Perhaps these contrasting images of additions to Volubilis, in their congruity and contrast with the ancient ruins, allow us to undo, to some extent, the claim of the 2002 edition of *Conservation and Management of Archaeological Sites* regarding the decision to shelter: 'inevitably [the shelter] is an impact on the site and an alien' (Agnew 2002: 9). They also illustrate how an assumption that shelters are something separate from the heritage and not an 'intervention in the fabric of the site' (Agnew 2002: 9) has misled designers who at times have become deaf to the prompts of the heritage values of the sites themselves. Perhaps all this points to the possible benefits of a shift away from large-span long-term shelters to localized shelters working alongside a series of seasonal measures.

FIGURE 14: Shelter over the Idrisid Baths at Volubilis (Morocco) (left) and an unknown visitor to the site (2016) (right).





Managing change, building capacity

The El Brujo archaeological complex (Peru), one of the most important religious and political centres of the Moche culture (Fundación Wiese 2007), like Çatalhöyük is an archaeological site that has thrived on long-term partnership. The site has already hosted previous generations of localized sheltering campaigns. Support for the site by the Fundación Wiese over several decades has included major research, which led to new discoveries and created new needs that the foundation also took within its remit (Fundación Wiese 2016). First a major new tensile shelter was installed in 2006 (Figure 15; Uccelli 2009), facilitating visitor access to the main pyramid shrine Huaca Cao Viejo. Then, to overcome the disorderly visitor and site-management facilities that had sprung up, a dedicated museum and visitor complex was created to allow, among other things, important new discoveries to be shared with visitors in close proximity to where they were found (Figure 16). The images that follow highlight just how this half-century journey has radically transformed this part of the El Brujo site.

The decision to create the Museo Cao so close to the main shrine of El Brujo may be controversial, particularly when compared to the views to the Huaca Cortada and Huaca Prieta across the landscape, which in contrast show a historic topography less shaped by modern interventions (Figure 17).

FIGURE 15 (right): Huaca Cao Viejo (Peru) with the tensile structure of 2,500 m², which was erected over the ceremonial square in 2004–05.



FIGURE 16 (below): The opening of the site to visitors in 2006 prompted the need for several facilities in proximity to the visitor itineraries for Huaca Cao Viejo. In 2009 the Museo Cao was created, where the first more informal visitor facilities had sprung up.





FIGURE 17: Huaca Cortada across the landscape; a contrast from Huaca Cao Viejo where modern intervention has proliferated.

However, when the management needs of El Brujo's archaeological remains and heritage shelters are paired with visitor and staff needs, the traditional 'settlement' that Museo Cao simulates takes on a different significance. In a relatively remote site like El Brujo, neighboured only by rural agricultural communities, this museum perhaps constitutes a hub of energy and interest, a staff and visitor community watching the site all year round. The heritage authority and its partners are repopulating this place after nearly one and a half millennia. It is the addition of this element that perhaps causes one's expectations of the lifespans of the different generations of shelters at El Brujo (only a few hundred metres away) to increase, reminding us of the dynamic and long-term nature of the sheltering process and the need for people-centred approaches (Wijesuriya and Court 2015).

Improving management approaches

The case studies above highlight very different experiences regarding if, when and how to shelter archaeological sites. The lessons to be drawn from local interventions at Volubilis (Morocco) are just as important as the knowledge gained from the challenges encountered in sheltering at Akrotiri (Greece) and Çatalhöyük (Turkey). Recent experiences all merge on one common point: the need to define current capacity and predict future capacity in all management areas. Likewise, two common errors continue to occur: the tendency to monitor only the physical shelter, rather than including management realities as well; and a general lack of familiarity with all components of management systems, which means that key management areas are often neglected.

To monitor a heritage management system effectively it is vital that all its interrelated components are monitored. For the purposes of the framework developed by ICCROM for World Heritage, these components fall into three categories: elements, processes and results (Figure 18; Wijesuriya, Thompson and Young 2013: 53–121). Usually there are two key elements – institutional and legal frameworks – that are the least subject to change. However, the political, economic or institutional instability of many countries in the Mediterranean, and indeed elsewhere, means even these require special attention. Often either short-term difficulties or chronic inadequacies, or a mix of the two, in a single area of the management system can be overcome by compensatory actions in other areas. If management reviews are carried out in a transparent and participatory way they can motivate others to help improve management of heritage.

The development of checklists for all management areas (Wijesuriya, Thompson and Young 2013: 53–121) and for all stages in the sheltering process (if sheltering is chosen over other options) could enhance decision-making relative to introducing or revising archaeological shelters. Table 2 provides some examples regarding how legal frameworks and institutional mandates can influence the capacity to procure new shelters or modifications to existing shelters. The considerations are particularly pertinent in the case of solutions with a large span and/or depending on modern technology (not vernacular building traditions), since these often require elaborate outsourcing of professional services, works and supplies.

TABLE 2: Example checklist of capacities in legal frameworks and institutional mandates relevant to a) deciding to shelter or not, b) procuring new shelters, or c) revising existing ones.

Is your heritage site World Heritage, thereby attracting obligations under international law, not just national law of local by-laws?
Is the management system for your site documented in any way? If not, do you have the capacity to start the process? This must include recounting the current situation in each area versus long-term expectations and acknowledging how current vulnerabilities will be addressed.
Have the very same steps been taken for documenting the site itself?
Does the heritage system at a national and local level have a tradition of commissioning modern integrations in heritage sites (visitor centres, archaeological shelters, other visitor facilities)? If not, the decision-making phase may need particular emphasis on: i) consultation and consensus building, and ii) checking management capacity to erect and care for shelters.
Will the public heritage authority be the contracting party (the client)? Does it have access to sufficient legal and administrative expertise for effective outsourcing?
Are legal frameworks in place at a national level to help ensure effective procurement processes that protect the contracting authority and the heritage to be sheltered in the case of procedural or technical failures in any phase of the process: during planning, during shelter construction and during a significant portion of its lifespan (e.g. set at ten years under European directives)?
Do suitable national-level instruments exist for commissioning works effectively? Can international standard contracts be adopted in their absence? Do they suit the particular demands of work with heritage?
If an NGO is the contracting party, is there provision for warrants and duties of care for outsourced services and supplies to be handed over to the public owner/institution responsible for the site?
Is scope to 'work with others' a concept sufficiently integrated into national legal and institutional frameworks for heritage but also at site-level management? Are there previous partnership experiences and relative agreements to draw on in the country/for similar sites in other countries?
Are documentation and archiving standards and timeframes for delivery (and related penalties) defined with external partners to ensure the authority legally responsible for the site in the long term is assured continuity of knowledge?
Managing change (project management) requires a different skill set and knowledge areas to sustaining 'business as usual'. Sheltering requires expertise in both areas. Do staff need capacity building to enhance their contributions?

For a management system to take on the additional management burden of shelters, particularly the case of ambitious large-span shelters, a shift from reactive management culture (acting when problems occur) to forward thinking (anticipating problems and hence avoiding them occurring or mitigating their impact, making the most of opportunities as they arise) is vital. If a continual process of anticipating and managing vulnerabilities does not become routine practice in all areas of management then shortcomings in legal and institutional frameworks, in resources (quality and flow) and heritage processes can lead to objectives not being met. Heritage practitioners should be routinely assessing the condition of the attributes of the heritage place itself. Essentially this same approach needs to be applied to an assessment of the management system as well. After the capital investment to define and analyse the specific management system and identify inadequacies and solutions (often in the context of a management plan; Wijesuriya, Thompson and Young 2013: 122–145), the skills and tools required to maintain this shift from reactive to proactive management

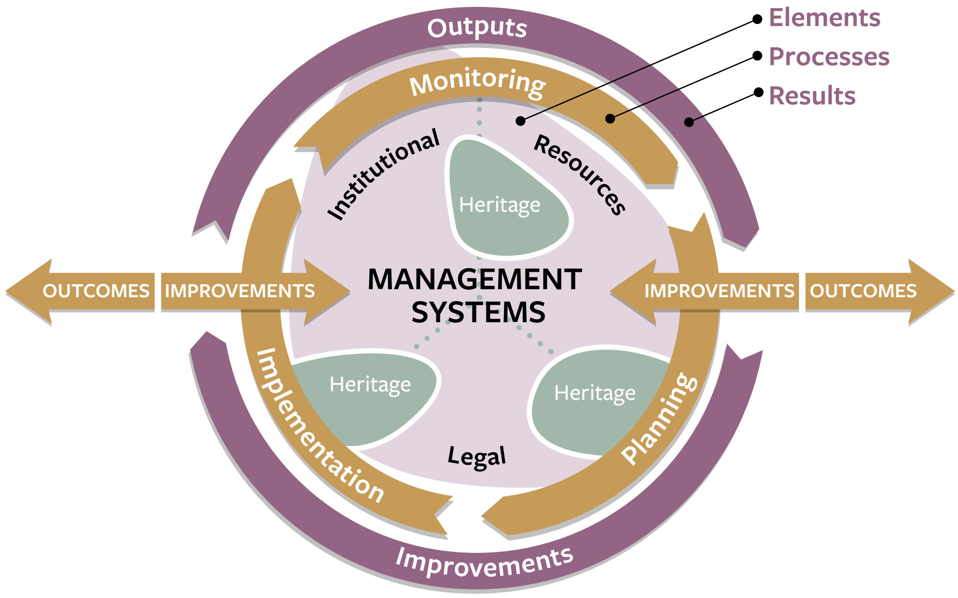


FIGURE 18: The common framework for understanding and monitoring heritage management systems proposed by the UNESCO resource manual *Managing Cultural World Heritage* (Wijesuriya, Thompson and Young 2013).

usually already exist, and often in other sectors where they have been better advanced. There are numerous risk assessment approaches from which to take inspiration but those most relevant for heritage management are: disaster preparedness (UNESCO 2010), project risk management (managing change; Association for Project Management 2017) and managing risk in operational procedures (in other words safeguarding 'business as usual' activities).

Working with others

The challenge of managing others is particularly significant when broaching the challenge of shelters since archaeology, especially classical archaeology of the Mediterranean, has been predominately state-owned and state-run in recent centuries. The decision to shelter can be the first occasion in which staff from the public heritage authority have to recruit external expertise and specialist skilled labour. Two contrasting scenarios can emerge:

- The public heritage authority carries out all management and conservation activities and there is no, or limited, experience of constructing effective collaboration with outside partners. When opportunities arise agreements can therefore fail to capture what is in the best interests of the archaeological site and/or the strengths of each partner.
  or
- The public heritage authority reduces its contribution to a regulatory one, essentially 'policing' the action of others (often foreign missions). As a result, insufficient expertise in core management and conservation knowledge areas is matured and internalized in the long-term institutional framework.

Both scenarios can lead to imbalanced partnerships that can favour the external party and the site in the short term, to the detriment of the long-term management effectiveness of the authority responsible for the site, and hence of the site's long-term interests. Often this imbalance can only be perceived with an in-depth knowledge of the national heritage management system and/or over a ten-to-twenty-year timeframe (often the maximum lifespan for a shelter in the absence of comprehensive maintenance).

One example is that of the rigid timeframes and accounting of finite collaborations associated with (among others) European funding channels, in conflict with the nature of working with ancient places where the scope, quality and performance of interventions are the parameters that should predominate over time and cost in project management (Burke 2003: 22). Another is that of partnership with charitable organizations given their need to keep supporters motivated and/or their limited appetite for open-ended commitments.

These phenomena can favour flagship projects for short-term visible change, often with increasing attention to capacity development for heritage management and conservation within local institutions and among local practitioners and communities,[9] but which have no guarantee of follow-up after a finite timeframe. Partnership for heritage conservation and management requires a very long lifecycle for effective and measurable results, something some international organizations operating in the sector for decades have come to recognize.[10]

Capacity building and going local

These case studies come together to highlight a core issue that is central to the shelters debate. Archaeological excavation as an activity creates new knowledge and opportunities but also gives rise to new needs and vulnerabilities. This is true for the ancient places exposed and also for those studying them, visiting them or living in and around them. Shelters are just one example. Interest in revealing our collective past comes at a price. The case studies explored in this chapter remind us of the dangers of approaches to management at a site level, which ignore any area of the overall management system in which they are unfolding. They also remind us of the dangers of ignoring the existing strengths of communities in and around such heritage, capacities that can be drawn on to enhance management, conservation and access (Court, Thompson and Biggi 2011). Such oversights can augment the levels of dependency on external support. Furthermore, those communities and their heritage, instead of building resilience, will become more vulnerable than before. For management approaches to be effective long into the future it is vital they draw on and develop capacities already residing among local institutions and local communities and networks (Eade 1997). This is the construct at the heart of the 2011 World Heritage Strategy for Capacity Building and vital for practitioners at all heritage places to integrate into their daily work (UNESCO 2011).

Assessing impacts, harnessing heritage benefits

The international community has promoted Heritage Impact Assessments (HIA; ICOMOS 2011) as a tool in recent years to evaluate the impact of change on cultural heritage places, particularly World Heritage. Methodology for HIAs is under review given that this type of assessment is relatively new and also that there is a need to integrate the tool into Environmental and Strategic Impact Assessments that are prevalent in other sectors. To date they have been used primarily to inform decisions around one-off development projects within or near sites (e.g. Rogers 2017) but it is increasingly recognized that the methodology HIAs represent could feed into all areas of heritage decision-making and shape everyday heritage management practice.[11] Essentially this means recognizing the inadequacy of many of our national heritage management systems, which are still rooted in the 1964 Venice Charter,[12] and defending only the physical attributes of the past, which can prove to be dangerous if done in isolation. It means checking every decision made against the need to safeguard or indeed enhance the heritage and other values of a place with due recognition for the diverse communities that hold those values (Hockings *et al*. 2008). Change must be managed in such a way so as not only to manage threats but also harness opportunities to increase the well-being of both heritage and of the communities within and around it, hence securing a more dynamic role for heritage in society. Such an approach brings together the two areas explored in this paper – values and management context – also through case studies. This is a conceptual shift that leads practitioners to view changes in heritage places with new perspectives, the cases of Chur (Switzerland) and El Brujo (Peru) being examples of this.

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[9] For example, the US has a particularly strong tradition of heritage philanthropy, from the World Monuments Fund (founded in 1965) on to the Sustainable Preservation Initiative and the Global Heritage Fund in more recent years.

[10] At the 2013 Hangzhou Congress on public–private partnerships organized by UNESCO, Luis Monreal, General Manager of the Aga Khan Trust for Culture, emphasized the need for partnerships to have at least a ten-year lifecycle in order to achieve lasting improvements to heritage management and the socio-economic benefits related to greater community engagement. Similarly the Packard Humanities Institute promotes a small number of projects that last a decade or more.

[11] The mainstreaming of a Heritage Impact Assessment methodology into early strategic planning and other areas of management was broached at the World Heritage Site Managers' Forum which accompanied the 41st Session of World Heritage Committee in Kraków in 2017.

[12] The Venice Charter is now over 50 years old and feeling its age in relation to our now broader and more articulate understanding of heritage. However, it remains very influential for many heritage practitioners (see Wijesuriya 2010).

Conclusions

Reviewing progress made and battles lost regarding sheltering archaeological sites in the more than ten years since the special issue of the journal *Conservation and Management of Archaeological Sites* on protective shelters (Matero 2002), which was a major milestone in the literature on the topic, conjures up the same mix of hope and despair to be found in frontier activities in other sectors. Analogies, despite all their limitations, can prove useful. Transplantation medicine is one of the most challenging and complex areas of modern medicine. The idea that internal diseases can be successfully treated by replacing a damaged or missing organ through transplantation has been generally accepted since the beginning of the last century (Schlich 2010). The massive challenge of transplant rejection, often requiring immediate removal of the organ from the recipient, is being overcome through progress in medical, pharmacological and surgical techniques. However, such progress is in vain until the acute worldwide shortage of organs is addressed, and, to quote one medic, 'This particular field involves medical ethics, religion, and society behavior and beliefs' (Beyar 2011).

Essentially we are in the same place when it comes to heritage and sheltering measures for archaeological sites. Significant technical advances have been made and there are many positive precedents to draw on, but until we acknowledge that there are wider factors affecting our ability to do a good job – factors that are often more difficult to pin down and manage – such progress is in vain and we will continue to stumble. Much like the medical example of the organ shortage for transplants, these factors are inseparable from social-cultural issues in the present: ethics, religion, societal behaviour and beliefs; how these shape institutional cultures and ways of life and, in turn, approaches to our common past, including our perception of heritage values and our capacity to manage continuity and change therein.

In 2002 Teutonico noted that 'A shelter must be regarded as an intervention with its own aesthetic, technical and environmental impacts rather than just a benign preventive measure'. This proved a long-sighted premise to what work on shelters in the decade thereafter went on to show: issues that emerged strongly from the case studies brought to the 2013 Symposium on Protective Shelters for Archaeological Sites. We opened the 2013 symposium with a concept paper that stated: 'It is also, perhaps, time to revisit the idea of the construction of shelters as an extremely specialized sector, and shift to seeing it as a protection process to which many heritage specialists and non-specialists can contribute.'

In 2017 as we publish the proceedings of the symposium, with more and more lessons emerging from the field, we can go one step further. A shelter must not only be regarded as an intervention with 'its own aesthetic, technical and environmental impacts rather than just a benign preventive measure' (Teutonico 2002: 87) but also as a change that introduces both risks and opportunities into a socio-cultural and management continuum. The increasing attention of the international heritage community (but also many national-level legislative and institutional frameworks) over the last decade to values-based approaches and the solid analysis of heritage values and attributes is emblematic. So is the importance given to understanding heritage management systems and managing change better, in particular through understanding where heritage capacities reside and who needs targeting to develop those capacities. These come together as part of a wider paradigm shift that places greater emphasis on the role of heritage in society today. Although many legal and institutional frameworks are yet to catch up, our sector can no longer limit its remit to preserving material traces of the past for future generations nor limit its knowledge areas to the technical sphere associated with conserving physical attributes of the past. New pressures and new expectations in the present require of us a plurality of approaches in managing heritage to meet the needs of diverse socio-cultural environments, and the decision to shelter and the process of sheltering are not spared this reality.

Indeed it is possible to conclude that it is by no means incidental that successful shelter experiences are often those that have known how to draw on those previously untapped heritage capacities among non-heritage institutions, among communities and networks.

These are realities that occur outside of our standard safe sphere of reference and from which forms of support can be drawn that enhance our ability to integrate values and management considerations into our decision-making processes of whether to shelter and, if so, how. Such wider consensus can help the individual overworked heritage officer address misgivings regarding the decision to shelter in a more informed way.

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Tobit Curteis

The use of environmental survey and monitoring in the design and evaluation of archaeological shelters

Next to mechanical damage, the principal causes of deterioration of archaeological sites and artefacts are environmental in nature. Deleterious factors range from extreme and short-term damage, such as direct rainfall washing away foundations and causing collapse or solar gain causing dimensional response and failure of the substrate, to long-term chronic deterioration such as fluctuating relative humidity causing damaging salt activity or microbiological attack.

The primary function of most archaeological shelters is to modify and control the environment to provide benign conditions for the conservation of the site. However, there is a long history of shelter designs that have been unsuccessful due to a failure to recognize this basic criterion. In the best cases this has merely hindered the performance of the shelter, with the effect that it provides less protection than it would otherwise have done. In the worst cases, and there are many, it has concentrated and exacerbated the deterioration mechanisms causing the sites to deteriorate at a swifter rate than would otherwise be the case.

The failure to recognize and incorporate good environmental design into shelters occurs sometimes as a result of the absence of suitably experienced personnel on the design team, but also due to the fact that such teams are often led and funded by those whose interest lies more in the aesthetic design rather than a shelter's functionality.

This chapter aims to outline the issues involved in assessing the environmental needs of a particular site, incorporating them in the shelter design and then monitoring the performance of the shelter over time. It is intended both to provide an overall understanding of the technical issues involved and also to provide site staff with the information necessary to commission effective and practical research.

Shelter design criteria

As with any conservation building project there is a range of criteria to assess, including aesthetics, costs and planning issues. However, the primary criterion should be the functionality and performance of the structure. If the aim of the shelter is to control deterioration then the following factors must be understood: 1) the nature of the damage; 2) the underlying causes of deterioration; 3) whether the deterioration is active or historic; 4) how the deterioration will be controlled by the shelter or other measures; and 5) other environmental risk factors.

To evaluate these factors it is necessary to review the physical history and present condition of the site and artefacts as well as the environmental conditions, both historic and current, which affect them.

Physical history and condition assessment

The starting point for any assessment of the environmental requirements of a new shelter is to establish the effect of the current and historic environmental conditions. This requires a detailed assessment of the current condition of the site to be undertaken, as well as an investigation into the physical history of the site (that is to say previous interventions that have taken place, both as early changes and later conservation, which have led to the current condition, as well as natural factors including landslips or flooding). This should establish how the observed physical condition is affected by current environmental issues, as well as how historic factors have impacted on the site.

In many, if not most, cases conservation professionals today are dealing with sites and artefacts that have undergone past conservation interventions (including the use of shelters, which may or may not remain). Even in examples where this is not the case, the conditions of the site are often affected by changes that occurred earlier in its history, including modifications to building structures or changes in use, as well as catastrophic events such as fire and flood.

Environmental assessment

In conjunction with the physical condition survey, an environmental assessment should be undertaken. There is a range of levels at which this can be carried out and a wide range of tools available. However, in most cases an iterative approach is most effective, both in terms of the scale of the environmental factors being assessed and the detail with which they are examined. Not only does this allow the investigation to be most effective, as it enables each stage to be evaluated before proceeding to the next, but it also allows it to remain cost-effective as there is the option to terminate the investigation when sufficient information is available.

It is important to recognize that an environmental assessment can mostly be undertaken simply using visual and low-tech means without recourse to complex instrumentation. Where instrumentation is required it is generally to test and refine a deterioration model established by the simple visual examination, rather than to establish that model in the first place. For this reason, all of the investigation approaches discussed below can be carried out with a minimum of specialist equipment. The key requirement, however, is that the person undertaking the assessment has a detailed understanding of the materials, deterioration mechanisms and environmental factors involved.

Weather

In historic structures the primary environmental factor, which drives all others, is the weather. Therefore, in almost all cases, the first level of investigation involves an evaluation of weather factors. The precise factors that are most relevant vary depending on geographic location and climate but typically rainfall, solar gain, wind and freeze/thaw conditions will be most important.

Of these, rainfall is among the most significant and complicated of factors as it needs to be considered in three phases. The initial phase is when rain strikes the site and is absorbed into the original construction materials. In the case of earthen structures this phase can cause disaggregation of the material, resulting in erosion and structural failure. In the case of stone, fired brick, plaster and mosaics, direct wetting can cause degradation of materials and salt activity, which can result in loss of cohesion and erosion (particularly if it occurs in conjunction with solar gain and wind, which exacerbate evaporation).[1] Most exposed sites will be subjected to this to a greater or lesser extent, but it can also occur in sites where existing shelters are badly designed and allow, for instance, wind-blown rain to enter the protected area of the site.

The second phase of damage from rainfall results from the accumulation of dispersed rainwater, which forms pools and channels, dissolving materials and washing away aggregates within the building fabric, sometimes leading to structural degradation. In extreme cases, this concentration of dispersed rainwater can cause a failure of the substrate or foundations,

[1] Aspects of salt deterioration in this context are considered in: Arnold and Zender (1987); Odgers *et al.* (2008); Price and Brimblecombe (1994).

bringing about collapse. This can result both from the topography of the surrounding land in unsheltered sites as well as from the use of badly designed or maintained rainwater disposal systems on sheltered sites.

The third phase of damage is caused by long-term exposure to water where microbiological attack can result, causing both aesthetic and physical damage, in particular to decorative surfaces, but also, in some cases, the degradation of the substrate. Depending on the material types, hygral expansion and contraction leading to structural failure can also occur. The presence of microbiological growth also acts as a sorbent surface, retaining further moisture and exacerbating the problem. Typically this occurs in badly drained sites, both those which are unsheltered and those with poorly designed shelters and rainwater disposal systems.

In conjunction with precipitation, possible groundwater sources should also be considered, including a high water table, underground watercourses (natural and manmade) and surface water, which penetrates and undermines the site. Although the symptoms are often similar to rainwater, the sources and therefore the control measures are often different (Massari and Massari 1993).

With all water types it is not simply the wetting phase that creates the risk but also the drying phase. Most archaeological sites are contaminated to a greater or lesser extent with salts and therefore cyclical wetting and drying can cause deleterious salt activity, resulting in a loss of cohesion of porous substrates (stone, plaster and brick in particular) or delamination of surfaces.

Solar gain is also commonly found to be a significant deterioration factor, due both to thermal expansion and contraction and the exacerbating effects that it has on materials which contain water, as discussed above. The dimensional response of materials is further complicated in most buildings and artefacts in that they are generally complex composite structures, which contain materials with different thermal responses. Therefore, dimensional change not only causes stresses within individual structural elements but also between adjacent elements, resulting in stresses which can often cause physical failure. Owing to the different thermal performances this can occur both during solar exposure, when the materials are heating, and after the object is in shade, when it is cooling. In some instances materials are photosensitive and exposure to high IR or UV levels can itself be damaging.

Wind has both a direct and indirect deleterious impact. Depending on the material of the construction, wind can cause disaggregation and erosion of the surface. This can be exacerbated by loose material, which is blown across the site, acting as an abrasive aggregate. Indirect impacts of wind include the increase in evaporation highlighted above, resulting in increased salt activity. Wind can also cause rain to be blown around protective structures, as well as driving marine aerosol into otherwise protected areas of an archaeological site.

Microclimate

Although microclimatic factors can cause equally severe damage this generally occurs over a longer period of time and can often be in the form of chronic deterioration rather than critical failure. However, deleterious microclimatic factors are generally more complex to identify and understand than weather factors, which are often comparatively obvious.

Many of the deterioration factors that occur in historic building materials are associated with moisture content, which is itself influenced by water vapour in the surrounding air. Key deterioration factors include salt activity in earth, plaster, stone and brick, as well as dimensional response in inorganic materials (such as clays) and organic materials (such as wood), causing stresses and failures within the structure, and microbiological deterioration, resulting in both aesthetic and physical damage.[2] Therefore, humidity, both relative and absolute, is a key microclimatic factor. Both types of humidity are affected by temperature

[2] Timber deterioration in uncontrolled environments is discussed in Curteis (2010).





FIGURE 1: A conservator undertaking visual condition assessment to evaluate changing rates of deterioration on the medieval tiles, during shelter tests at Cleeve Abbey, UK.

and so, while the direct effect of air temperature on the materials can be limited, the indirect effect can be considerable.[3]

The nature and risks associated with microclimatic conditions vary greatly between internal and external spaces. Therefore, while the microclimate that is in close proximity to an exposed mosaic is likely to be highly unstable and follow the prevailing weather conditions, the microclimatic factors within an enclosed site, and the associated deterioration mechanisms, are likely to be very different.

Tools for investigation

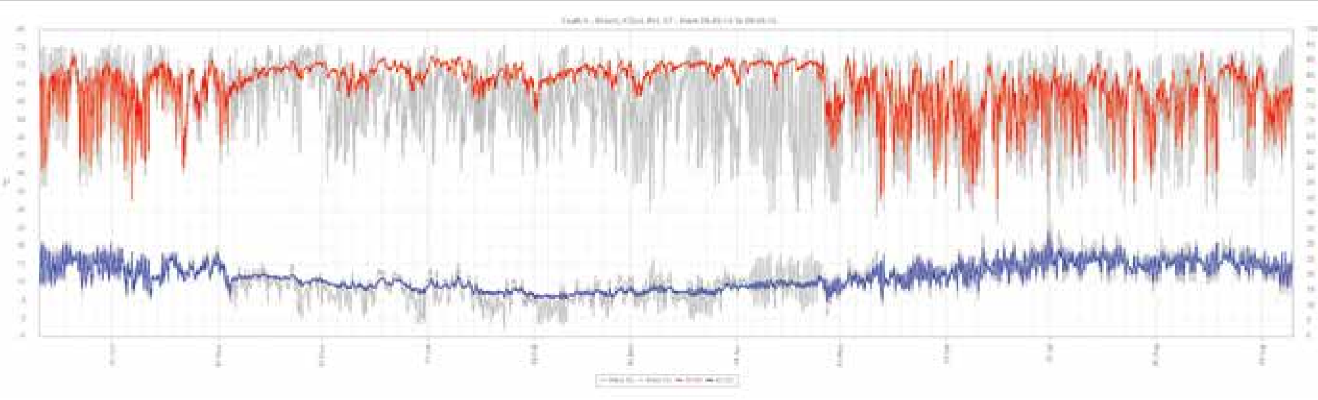
The main tool in all physical and environmental investigations is visual inspection. The physical condition of the site should be carefully assessed and a correlation made with the weather factors and the microclimatic conditions to which it can be seen to be exposed. In all but the most complex cases, one is not looking for accuracy and precision but rather a general correlation of factors; that is to say the similarity between the nature and patterns of deterioration and the type and distribution of the damaging environmental conditions. It is often extremely helpful to use basic graphic documentation techniques to map deterioration types and their distribution and then to overlay them with the environmental factors. For this reason an accurate measured/topographical survey of the site and the surrounding land is an invaluable tool (Figure 1).

It is also important to allow a sufficient period to observe the site, as one of the characteristics of natural environmental conditions is that they change over time. The speed of change might be diurnal or seasonal and so observing the site during all of the relevant periods is important. As this observation can take place over a long period of time this low-tech data-gathering process is sometimes carried out by more than one person; it is therefore important to establish precisely how the data will be recorded. What one person describes as *severe delamination* might differ significantly from how a second person considers the same condition. Therefore, preparing a written protocol at the beginning of any long-term inspection, be it by an individual or multiple people, is extremely important. This is also an opportunity to record the anticipated deterioration model that is being tested by the simple data-gathering exercise.

[3] It is often taught that while temperature has a direct effect on relative humidity it has no effect on absolute humidity (absolute moisture content). While this may be true in a modern structure, where the building material is non-porous, in most historic structure the building materials are porous and absorb and evaporate moisture. Therefore, it is often the case that when temperatures are low and relative humidity is high moisture is absorbed into the porous fabric. However, when the temperature increases the moisture in the fabric evaporates and therefore while relative humidity may fall, absolute humidity may rise as a greater volume of water vapour is present. However, if well understood this buffering capacity may provide a useful tool for passive environmental control. See Eshoj and Padfield (1993).

In all but the most challenging cases the basic deterioration model is established by this type of visual inspection. Complex instrumentation is largely used to refine the model and produce a more accurate understanding. The instruments used in this capacity can broadly be separated into those used for *measurement*, that is to say obtaining spot readings of data, and those used for *monitoring*, or gathering long-term patterns of data.

Both types of data can be extremely useful, but it is essential that there is a clear understanding of which data type is required and how it will be used. For instance, if the question is, *at present does the pattern of superficial moisture correlate with the damage pattern?,* a series of spot readings with the appropriate tool may be sufficient. If, on the other hand, the question is *do the moisture levels in the material vary over time in relation to changing weather patterns?*, then environmental monitoring may be the appropriate tool. In other words, it is extremely important not only to establish the correct question but also to understand how particular instruments work and the nature of the data that they can provide (Figure 2).



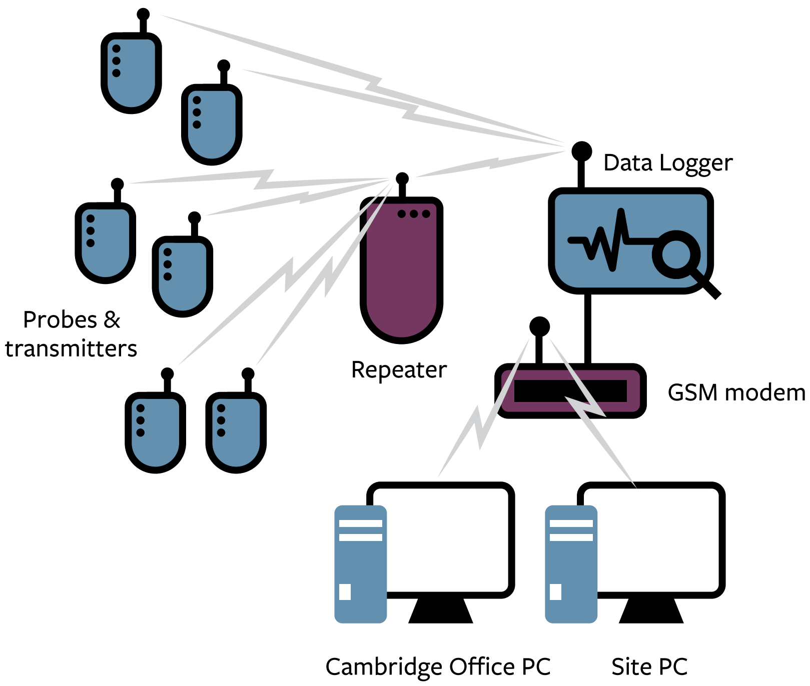
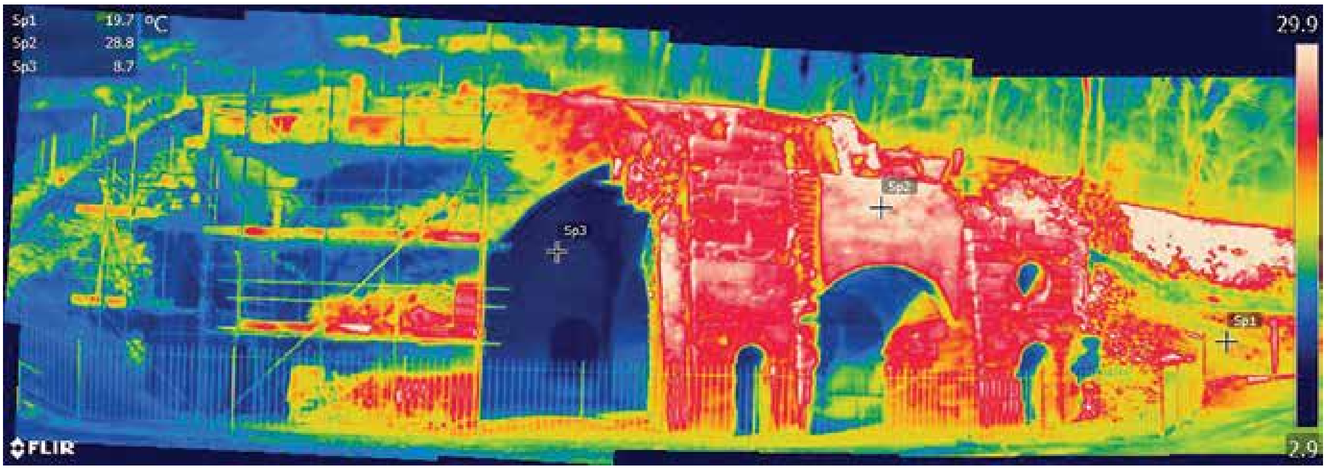


FIGURE 2: Environmental monitoring system and data from the trial shelter at Cleeve Abbey, Somerset, UK.



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FIGURE 3: Infrared thermography image showing the effects of solar exposure and evaporation of groundwater on the ruined structure of the eighteenth-century Bedlam Furnaces at Ironbridge, UK.

For instance, both environmental monitoring and infrared thermography (thermal imaging to identify surface temperature variations) are commonly used in this context. Thermography generally provides a spot reading of temperature patterns but over many thousands of points (Figure 3). Therefore the data has high spatial resolution but minimal temporal resolution. By contrast, environmental monitoring is used to provide long-term temporal data but over comparatively few points. Therefore, accurately defining the questions that need to be answered is critical in choosing which tools will be most appropriate for the investigation.[4]

Other typical instruments for spot readings are electrical moisture meters (sensors which measure an electrical parameter, generally capacitance or resistance, which is influenced, in a predictable manner, by moisture content), for superficial water, humidity and ambient temperature meters for ambient microclimate, and lux and UV meters for visible light and radiation exposure. All have their place in this second stage of an investigation but it is essential that the practitioner fully understands both the materials that they are investigating and how the instrument actually works. Most of these tools measure a proxy value (often an electrical effect of some type) rather than the actual parameter about which information is required.[5]

Commissioning and managing investigations

Commissioning investigations of this type can be fraught with difficulty and is often where projects fail. It is commonly the case that the client does not fully understand the information they require, the systems they should use to obtain it in the most efficient way, nor how to identify and instruct an appropriate consultant. To further complicate matters, commercial suppliers often have an interest in supplying the data that is produced by the tools that they own, irrespective of how appropriate it is for the particular application. The situation can be made worse still by the fact that, in many cases, investigations are commissioned and delivered in isolation from the rest of the project and that the project manager may see it as their job to coordinate and correlate the data, irrespective of their ability to do so.

A further common problem is the project sequence and timetable. Since large archaeological shelter projects often have a political element it is not uncommon for a shelter design to be developed in principle before the question of functionality (what it actually needs to do) is fully considered. Therefore, performance research takes place part-way through the project rather than right at the beginning when it would have been most useful.

As a client it is essential to recognize that data is not information. A good conservation consultant should be able to guide the project manager through the information they require,

4 Approaches to investigations are discussed in Pender, Curteis and Ridout (2014).
5 Best practice for the use of electrical moisture meters is evaluated in Eklund *et al.* (2013).

the data they need to produce that information and the most timely and cost-effective way of gathering the data.

Once investigations are underway it is important for the project manager and consultant to continue to revisit and evaluate the original questions, to retain an overview of the project and the reason for the data collection. All too often there is a tendency to concentrate on technically complex issues, such as relative humidity, while part of the site is being washed away by rainfall.

The best project teams work as a cohesive whole. The project manager or client might be the final decision-maker, but they should work closely with all the consultants (often including conservators, material specialists, archaeologist, hydrogeologist, engineer and architect), who should be part of the team from the development of the initial questions, through the design of the shelter and its delivery, and then through the evaluation process once it is in place.[6]

Developing the shelter design and anticipating performance

Once there is a thorough understanding of the active deterioration mechanisms and the way that they are related to current and future environmental factors, this information should be fed into the shelter design process at the earliest stage, so that the design is led by performance in balance with 'aesthetic criteria'. Although, ideally, one requires both, it is better that a shelter performs well and is less beautiful rather than beautiful and not functional.

The information from the investigations demonstrates how a shelter structure has to perform in order to produce an environment conducive to the conservation of the site. This then needs to be integrated with the materials and design of the shelter and an evaluation made of what the actual effects of the complete design are likely to be.

At this stage in the design process the engineer and architect should be working closely with the conservation consultant in developing the shelter design and materials as an iterative process. Regrettably, in many cases, the conservation and environmental research is simply passed to the engineer and/or architect who develops the design with no further reference to the consultant. As most engineers and architects are not familiar with the details of the conservation and environmental issues involved, the result can be a design that meets their functional criteria but actually misses the conservation requirements.

Often problems occur when control systems that are familiar to architects and engineers are added to conservation shelters in the absence of consultation with the conservation consultant. A typical example is the use of mechanical air conditioning where humidification/dehumidification is introduced by the engineer; producing accurate conditions in the air mass but transferring environmental stresses onto the artefacts.

It is also important to examine both direct and indirect effects of shelter structures on the site as a whole. For instance, a coastal archaeological site might suffer from solar gain and rainfall, and a shelter might be constructed in order to protect it from these specific factors. However, it is likely that a coastal site will also be subject to marine aerosol and that the sodium chloride deposited onto the structure is regularly washed off by exposure to rainfall. Once the shelter is in place, and the site is protected from rainfall, the accumulation of sodium chloride may be greater and the risk associated with salt deterioration may in fact be more severe than the damage caused by the rainfall.[7]

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[6] This process is considered in detail in Getty Conservation Institute, Historic England and Israel Antiquities Authority (forthcoming).

[7] These issues and associated risks are developed further in the chapter by Rizzi in this publication.

Possibly the most significant issue is that of rainwater disposal, although it is so obvious it is often not given the priority and design importance that it deserves. However, if the rainwater disposal system is badly designed it can cause the most severe mechanical and environmental damage of all parameters. Therefore, in most parts of the world, among the very first issues raised for shelter performance should be the question: *how will it take water away from the site?*

To summarize, the key to a successful functional design is to have an integrated team throughout the research and design process and to ensure that the design is led by performance criteria and supported by good research, with aesthetic considerations following. In all too many cases which function badly, the design team is compartmentalized, performance research has not been carried out in a timely manner and the design is led by aesthetic considerations.

Evaluation of shelter performance

Due to the structure of building projects – whether domestic residential, commercial offices or conservation shelters – in most cases, once the construction phase is finished and the period to rectify defects is complete, the design team and professional advisers disperse and no evaluation is made of actual performance. As a result, the model developed during the design, whether it is a sophisticated computer simulation or a simple written description, is rarely tested. Not only does this lead to a lack of evaluation of the performance of the structure but it also means that development across the field is limited. If it is not known how a design actually worked in practice, how can future problems be avoided and how can designs be improved? Therefore, evaluation and monitoring of the actual shelter performance is essential both for developing designs and also for assessing the conservation impact on the site and artefacts (Curteis, Lithgow and Bullock 2007).

The principles involved in performance evaluation are very similar to the initial assessments made prior to the design of the shelter; that is to say, an evaluation of the changing physical condition of the site and artefacts correlated closely with an assessment of the environmental conditions to which they are subjected. The additional layer of investigation at this stage is, of course, the building structure itself.

In addition, there is the complication of the effect of visitors, the numbers of which may increase as a result of the development of an archaeological site and the construction of a shelter. People expire significant levels of moisture and radiate heat. While this may be of little consequence in a large site or an open shelter, in small spaces and enclosed shelters the impact may be significant.[8]

As with the initial investigations, there are a number of levels at which this can take place. The simplest investigations, which should be carried out in all cases, involve the evaluation of the rainwater disposal system. When it rains, is the water successfully removed both from the shelter structure and from the site?

Investigating whether the microclimatic conditions have been modified in a beneficial way is more complicated in the short term, and may involve the type of instrumental investigations outlined above. Therefore, while this may be appropriate for a well-funded project, in other circumstances it may not be possible. Where this is the case, a more pragmatic approach should be taken. Does condensation form on the shelter and is it draining onto the site? Is there an increase or decrease in microbiological growth causing damage to the artefacts? Is there an increase or decrease in salt activity? By assessing the physical symptoms one can indirectly assess the environmental performance of the shelter and establish in basic terms whether it is functioning in a beneficial way or otherwise.

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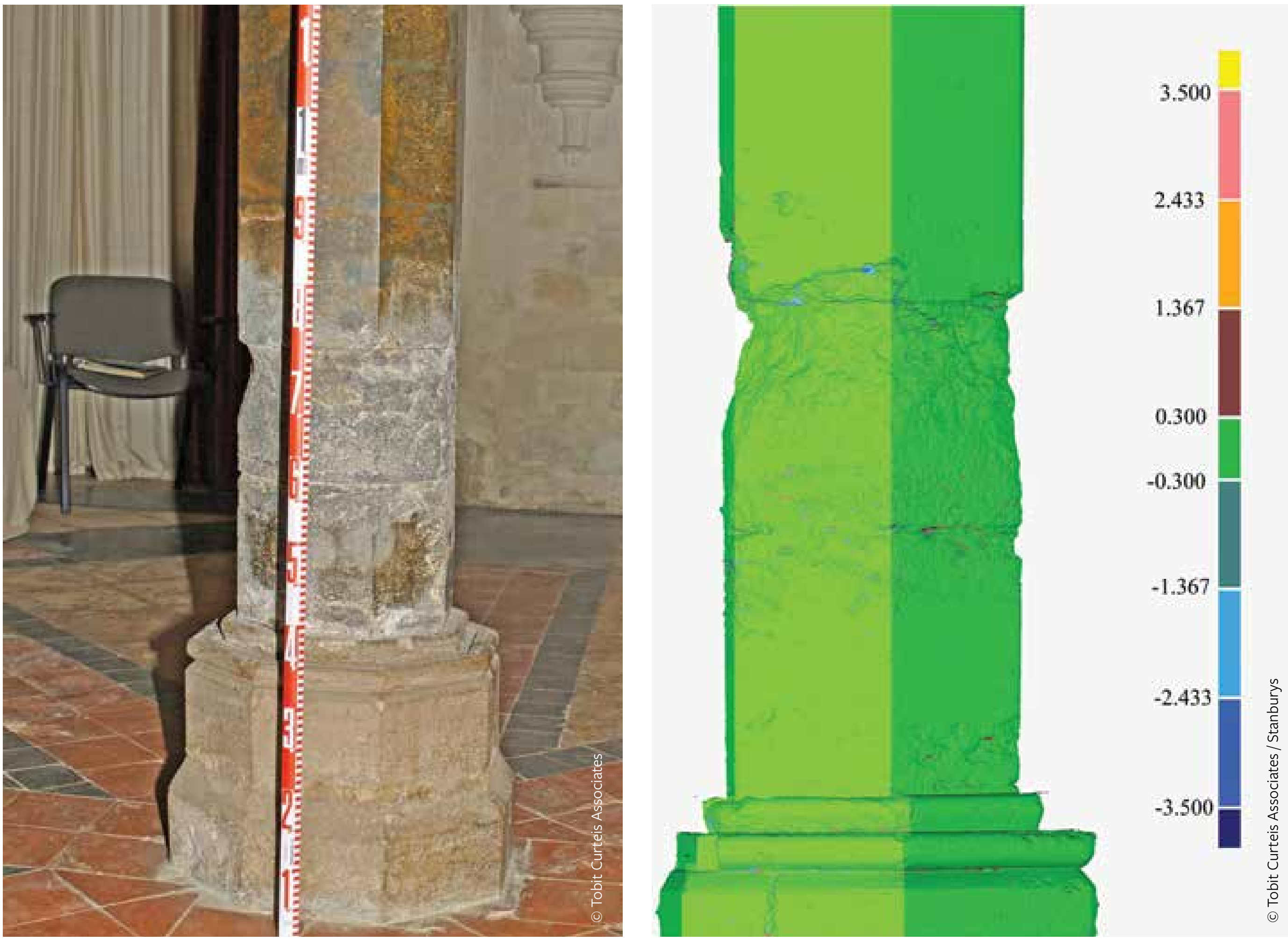
[8] People expire approximately 30–70g/h depending on activity levels and temperature. See TenWolde and Pilon (2007) and Camuffo (1999). The effects are observed in many small sites but most significantly in those with low air exchange rates such as crypts and hypogea.

The key to establishing whether the shelter is improving the environment is the condition of the site and artefacts themselves and whether the rate of deterioration has been reduced. Establishing the deterioration rate in the short term can be difficult unless the damage is severe. The use of periodic close-range laser scanning can be extremely useful in looking at very small changes in surface topography over short periods of time and can give a swift indication of rate of deterioration (Figure 4). However, care must be taken with this and other techniques as loss of material may in fact indicate a slowing down of the underlying cause of deterioration. A typical example is when a wet site is slowly dried, as there may be an escalation in salt activity and therefore superficial deterioration before the physical condition stabilizes.

However, in many projects costly technology, such as laser scanning, is not available and, in any case, is inappropriate. More basic manual condition recording (plotting condition data on photographs) remains an extremely robust and simple technique, which is easy to repeat, understandable to all and is low cost.

Long-term environmental measurement and monitoring may be carried out in more complex cases or at sites where the archaeological material is of extreme sensitivity and/or significance. This may consist of taking a series of spot readings at predetermined times or of installing electronic environmental monitoring equipment, which records constantly. If the former approach is taken it is important to understand the limitations of the data (for instance, spot readings do not allow an examination of diurnal fluctuations) but, if the correct questions are asked, it can still be a useful tool. In sites where environmental monitoring is justified for post-completion performance evaluation it is generally necessary to have undertaken pre-intervention monitoring so contextual data exists against which the changes brought by the

FIGURE 4: Periodic laser scanning was used to evaluate minor condition changes in the medieval columns at Anglesey Abbey, UK.



shelter can be evaluated. If environmental monitoring is undertaken it should be designed and implemented by a practitioner who understands both the conservation issues associated with the materials, the way in which the electronic data gathering works, and the software tools required for good analysis and interpretation of the data. Once again it should be emphasized that the data itself is not useful, it is the information that results from good interpretation which is of use. It is also important to understand that the design and installation of the monitoring system is an integral part of the process. Environmental data should not generally be gathered by one party and analysed by another.

Whatever techniques are used for long-term condition and environmental assessment, it is important that there is a clear written methodology at the outset and that sufficient resources are allocated to the monitoring process. This element of the conservation process is just as important as the design and implementation of the shelter and should be given due priority and funding.

Discussion and conclusions

In most cases, the primary function of any archaeological shelter should be the modification and control of a deleterious environment so as to produce benign conditions for the site and artefacts. It is required to be aesthetically sensitive in order that it can support the effective presentation of the site rather than detracting from it. Both elements of the design are important, however in order to enable successful conservation it is essential that the environmental performance of the shelter is effective rather than that it is a thing of beauty, although this is also a desirable attribute. In short, the design of the shelter should be led by the environmental and conservation performance rather than the aesthetic.

For this to happen, it is important that the project team includes an environmental and conservation consultant throughout the process and that the basic assessments and performance criteria are established at the earliest stage. The conservation surveys and environmental assessments can range from basic low-tech and low-cost approaches to sophisticated instrumental research. However, in most cases it is the basic examination and development of a simple performance model that is most important. This requires the consultants to have a thorough understanding of the historic materials, the deterioration mechanisms and the control possibilities of different shelter designs and materials.

In many cases where shelters have been unsuccessful, projects have been led by the aesthetic features meaning that the conservation and environmental information necessary to ensure effective functional performance is either not collected or it is given second place to the aesthetic design. Where environmental performance data is taken into account this is often communicated second-hand via the engineer and the architect, as the environmental consultant remains outside the core project team. This leads to misunderstanding and misapplication of the information, with the result that the performance of the shelter suffers.

Following the completion of the shelter and any other conservation measures, it is important that long-term evaluation and monitoring takes place, both physical and environmental, in order to ensure that the shelter is functioning correctly and providing the necessary benign environmental conditions. This also provides information to the field in general on the performance of different shelter systems so that future designs can be improved.

A successful shelter design can reduce the rate of deterioration of an archaeological site dramatically, and ensure its long-term conservation. An unsuccessful shelter design can concentrate and accelerate deterioration equally dramatically. There is a long history of failed shelter designs in this field and, in many cases, this appears to be due to a lack of understanding of the underlying causes of deterioration and the anticipated impact of a particular design. With careful project planning and an understanding of how conservation and environmental information fits into the design process this can be avoided.

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Gionata Rizzi

Considerations on archaeological shelters: a practitioner's viewpoint

Having thought about and worked with shelters for many years it is very clear to me: shelters are an evil. Sometimes a necessary evil but still an evil. It is hard to name a site that is not better and that would not be made better without a shelter.

That is why it seems to me that the first rule of good shelter design is to think twice before deciding to go for it. The number of shelters that have been built, from Central America to the Middle East, is stunning: from the thatches that have been put above every single stela in Quiriguá (Guatemala) to the polycarbonate sheets that visually pollute access to what has been called 'the Sistine Chapel of Mayan art' in Bonampak (Mexico).

In a word, a site manager (whether an architect or an archaeologist) should always assess carefully the reasons for building an alien structure on top of a ruin. In Quiruguá it seems that the thatched roofs were mounted to avoid algae and mosses growing on top of each stela (a problem that probably could be solved by spraying the stone each year with benzalkonium chloride in a solvent form or by fixing a temporary 'architectural hat' on top of the stela just for the rainy season). Instead, incongruous thatches have been mounted on long poles above these works of art, which not only alter the view of a cultural landscape but also discharge a large quantity of rainwater along the perimeter, creating a pond that feeds the stone with water, which then rises by capillary action and damages bas-reliefs that otherwise would remain as sharp as if they had been just carved (Figure 1).

In short, a site manager should be aware not only of the changes in the way in which a site with a shelter will be perceived (sometimes as visual disasters), but also of the technical problems that a shelter may create for its own maintenance and for the preservation of the archaeological fabric itself. I hope I will not be accused of biting the hand that feeds me: whenever I have felt it was possible, I have discouraged the idea of building shelters.

On the Great Saint Bernard Pass in the Alps, I was asked to come up with a proposal to protect the remains of Roman *mansiones* (Figure 2). Instead, I suggested burying them. I sensed that in those conditions (up to 4 m of snowfall in wintertime) a shelter would have to be so massive that it would have totally overwhelmed the poor remains; remains that, after all, have been repointed and retouched so many times that, by now, they retain very little authenticity. So I felt that what mattered the most in this case was not to look at them but to perceive their presence: hence I suggested burying them in a way that created a sort of embankment or a scar in the landscape that would puzzle people; when people are puzzled, they start to think.

Another case is the Maya site of Kaminaljuiu in Guatemala City (Figure 3). Here the excavation, a rectangle of 12 x 20 m, certainly needs to be protected because of its archaeological value but does not need to be accessed by the average visitor: the maze of walls that cross each







FIGURE 1: The stelae at Quiriguá (Guatemala) are under the cover of small thatched shelters to counteract the formation of moss and algae caused by water penetration into the stone. However, the design of these shelters has subsequently created a new conservation challenge with inadequate provision of drainage for the rainwater that now pools underneath them.

other in an 'architectural *imbroglio*' at the bottom of the excavation does not need to be *understood* but, rather, it should suggest to people viewing it from the edge that all over the park they are walking over the remains of time past. Hence the idea to allow people to glimpse their past as if through the pages of a gigantic book.

As should be clear by now, deciding upon and designing a shelter is not only a technical activity but is tightly interwoven into the interpretation and presentation of the site. And this is why the architect ought to be involved in the planning phase from the beginning.

We move now to cases where sheltering was unavoidable: Herculaneum and Piazza Armerina (Italy), and Copàn (Honduras). Herculaneum contains a lot of mosaics and other finishes (mural paintings, stuccoes) conceived and constructed to be indoors but which are now exposed. Here we built two medium-term roofs, the weight of which is carried entirely by the boundary walls (Figures 4–5). In this way we avoided putting struts in either side of the walls, which would have been unsightly in the context of a site that has been largely reconstructed and that, by now, looks more like a historic centre than like a fragmented ruin (Pesaresi and Rizzi 2007).



FIGURE 2 (above): The remains of the Roman *mansiones* on the Great Saint Bernard Pass (Switzerland) where a protective shelter would have overwhelmed the archaeology.

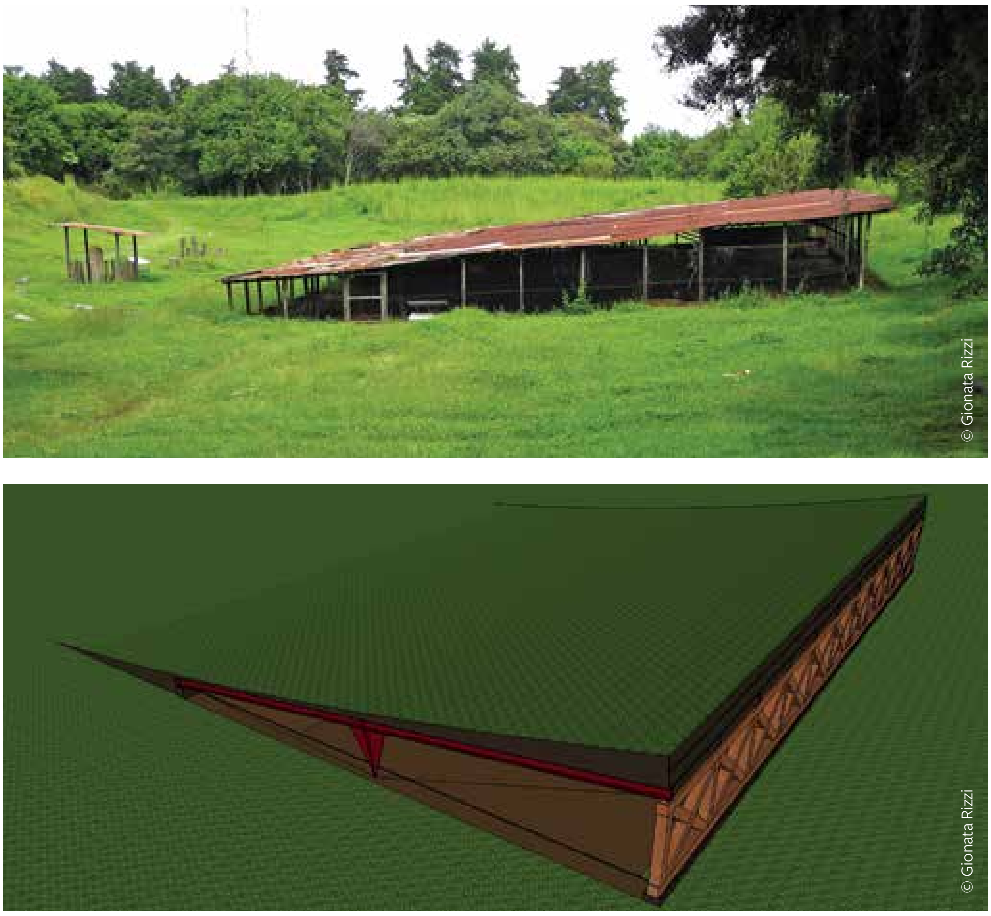


FIGURE 3: Shelters at the Maya site of Kaminaljuiu in Guatemala City.



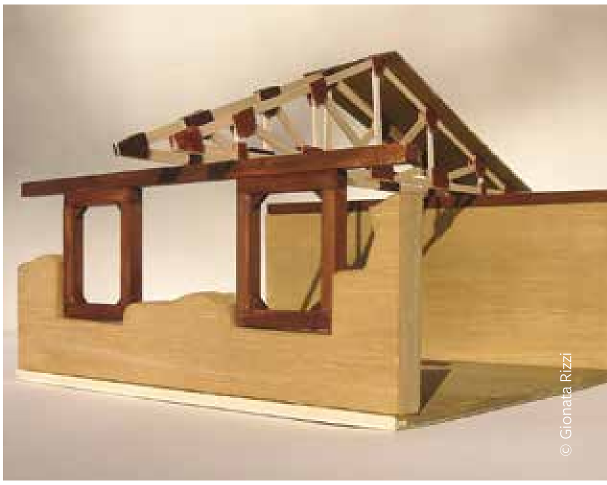


FIGURE 4: New shelter design (above) and construction (left) for the House of the Telephus Relief at Herculaneum (Italy).



FIGURE 5: The House of the Gem at Herculaneum (Italy) before (left) and after (below) the protective shelter was installed.





FIGURE 6: The Villa Casale at Piazza Armerina (Italy) with the old shelter (right) and the new shelter (below).



The Villa del Casale at Piazza Armerina is a very controversial project because it replaced a shelter built in the early 1960s that is considered a milestone in archaeological intervention (Figure 6). Here we retained much of the museological approach (walkways on top of the walls, allowing people to look at the 4,000 m^2 of mosaics without treading on them) and we changed the translucent envelope with opaque panels and opaque roofs to get rid of the greenhouse effect and to restore the original condition of the light in which the mosaics were seen: not a glare but a penumbra (Rizzi 2008).

Copàn in Honduras is probably the most difficult project I was involved in in terms of design because we totally lacked formal references: pyramids, even in the New World, never had a roof. The project was initiated by the Getty Conservation Institute because the stairway, which bears hieroglyphs on each raiser, was wrongly treated with acrylic resins in the 1970s and, as a result, can no longer be exposed to the tremendous downpours of the tropics (Figure 7). After many years of silence the project was revived by Harvard University who picked up one of the four alternative proposals we had submitted to the Getty Conservation Institute and brought it a step forward with a prototype in scale 1:5. Here the problem was solved by a series of rhomboid sails folded in the middle and attached to poles supported by two parallel cables running top to bottom (Rizzi 2011).

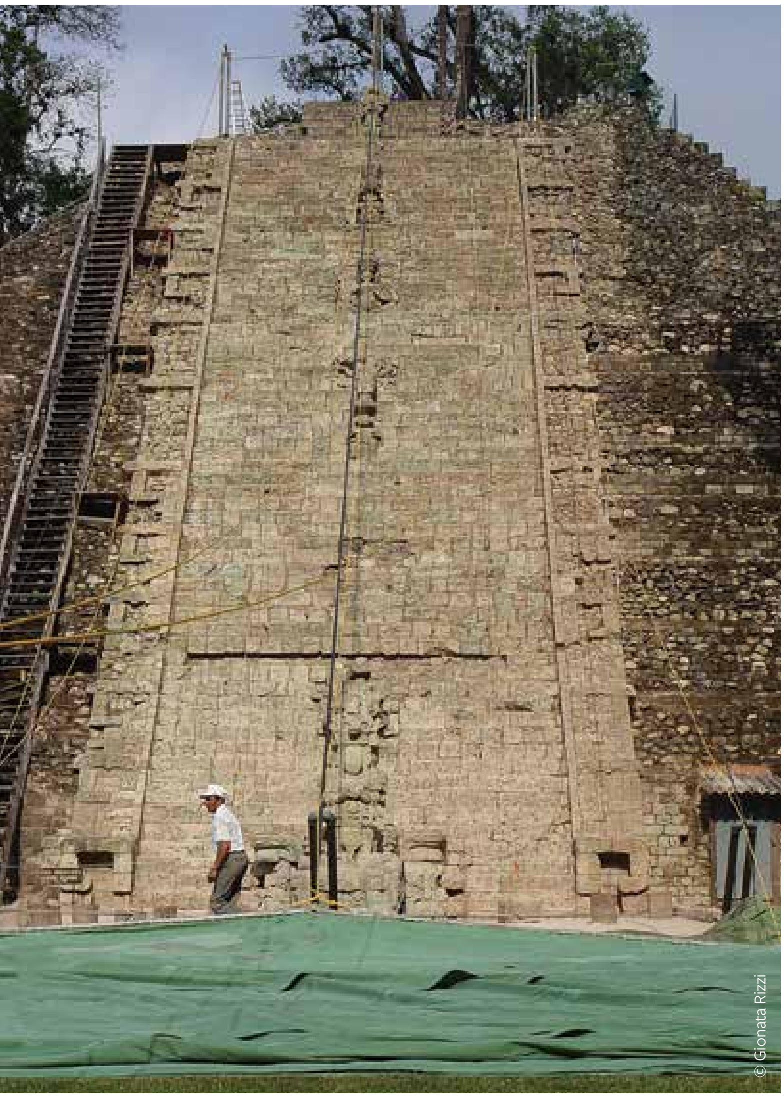


FIGURE 7: The pyramid at Copàn (Honduras) presents significant challenges in designing a suitable shelter. One proposal is to create a chain of rhomboid sails, shown as a prototype (below).



Indeed, when there is no choice but a shelter its design is a real challenge because many aspects have to be taken into consideration:

- technical (including foundations, wind loads, earthquakes, durability of materials, need for maintenance, costs);
- conservation (including effectiveness of protection, wind-driven rain, new microclimate induced by the shelter);
- aesthetic (including materials, form, overall effect both from outside and inside);[1]
- impact on the site as a whole (very subjective but nevertheless crucial);
- interpretation and presentation (where the working relationship between architect and archaeologist must be very close).

It goes without saying that in order to tackle all this at once, one needs to approach every site as if a new adventure: a technical adventure, an intellectual adventure and an aesthetic adventure. An adventure for which, I am afraid, standards and guidelines are of little help.

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1 To this point I'd like to add a word against those who fear that a shelter which looks too good detracts from the ruins it is meant to protect: have you ever seen a beautiful woman not wanting to wear a beautiful dress because it would detract from her own beauty?

Paola Pesaresi and John Stewart

Shelters evaluation, monitoring and maintenance in the context of archaeological site management

Shelters are encountered on many archaeological sites of the Mediterranean. Their presence is mostly related to the need to protect specific architectural or decorative features, exposed during excavation and believed to be too fragile to be left exposed. Consequently, shelters tend to be isolated, or randomly scattered within the archaeological site (Figure 1).

The process of planning, designing and building shelters usually follows the period immediately after excavation. If the area to be covered or the setting is particularly complex, a provisional shelter is often provided while funds are raised for the design and construction of a permanent one. If these do not become available then provisional shelters themselves often become permanent (Figure 2).

Sheltering on an archaeological site brings formidable challenges and contradictions. On the one hand, a shelter should confer good protection to the archaeological remains below by reducing the rate of deterioration from environmental causes. On the other, it should impose the least possible aesthetic impact on the site, and harmonize with the archaeological and natural landscape. It also needs to provide quality in the visitor experience in presenting the protected remains.

FIGURE 1 (below left): Pompeii has a wide range of different shelter typologies, both traditional and modern.

FIGURE 2 (below right): This 'temporary' shelter at the Villa of Theseus on the site of Kato Pafos, Cyprus, remained in place for around twenty years. When completely derelict it was eventually demolished, but the intended permanent shelter has still not been built some fifteen years later (see the chapter by Solomidou-Ieronymidou, Kaldeli and Charalambous in this publication).


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FIGURE 3: The modern 'glasshouse' shelter over the Villa Casale at Piazza Armerina, Sicily (Italy) was designed in the 1950s by the architect Franco Minissi, who was influenced by the eminent theoretician Cesare Brandi. It developed iconic status as a modern classic design, and its demolition 50 years later to make way for a new structure with a better internal environment was highly controversial.

There are two functional typologies of shelters on Mediterranean sites:

- A roof structure supported by the walls of the ancient structure (or modern masonry on top of it): this may mimic the ancient roof structure or be entirely modern in form; roof drainage is often problematic.
- An entirely modern 'umbrella' structure covering an ancient structure, which either forms a full enclosure with vertical cladding or is open on all sides.

In terms of aesthetic design, shelters may employ similar vernacular materials to the ancient remains they protect (e.g. brick and ceramic roof tiles). At the opposite extreme is the conscious use of modern architectural forms that contrast demonstrably with ancient remains (e.g. light-weight pre-tensioned synthetic fabric on metal frames).

Attempts to protect ancient structures with shelters followed excavation on some sites from the late eighteenth century. This was clearly in recognition of the vulnerable nature of such features as wall paintings and decorative stucco. Some shelters may themselves have subsequently gained historical importance, either from their age and contribution to the post-excavation history of the site, or from their intrinsic design qualities (Figure 3).

If the legacy of shelters is long, their existence is doubly problematic in functional terms. The protective function of shelters is often compromised by poor design and this is aggravated by the lack of systematic maintenance.

This chapter presents issues relating to the evaluation of shelters, their maintenance, and planning for modifications to them. It is directed to managers of Mediterranean archaeological sites with shelters, and provides guidance on practical measures to understand the performance of shelters and to maintain them.

Problems related to existing and new shelters

Deterioration of ancient and modern building materials and structures

The primary environmental agents of deterioration of building materials, both ancient and modern, are physical, chemical and biological.[1] Their impact on ancient remains depends on their frequency of occurrence, their aggressiveness, and the inherent condition and resistance of the ancient materials.

Consequences of shelter design and materials

Many shelters encountered on archaeological sites fail to protect ancient remains because of a fundamental lack of understanding of the causes of deterioration specific to the site and its ancient materials. In commissioning a new shelter design, the official 'custodian' of the site (e.g. a national heritage authority) is usually unable to articulate shelter performance requirements to the architect; faced with an unusual building typology and the lack of a clear design brief, the architect makes compromises that would not be sanctioned in a more routine building.

TABLE 1: Examples of the potential physical impact of shelters on ancient remains

IMPACT ON MATERIALS AND STRUCTURE	INFLUENCE OF SHELTER DESIGN (MORE THAN ONE PARAMETER MAY BE PRESENT)
Soluble salts (all porous materials)	Semi-enclosed shelter (marine environment): containment of chloride aerosols
	Strong internal ventilation (tunnel effect): rapid evaporation from surfaces
Microbiological growth and their succession (all porous materials)	Shaded conditions in conjunction with poor ventilation
	Leaks in roof cladding: moisture source
	Poor perimeter ground drainage: moisture source
	Metal roof structure: moisture source (condensation)
	Open shelter: inadequate shield from lateral rain penetration
Surface staining (corrosion products)	Corrosion of metal roof structure: condensation and/or leaks in roof cladding
Detachment of mosaic surface, loss of tesserae	Direct solar radiation on surfaces: differential thermal expansion/contraction
	Poor perimeter ground drainage: differential hygric expansion/contraction
Corrosion / heave (of mosaic relayed on iron-reinforced concrete)	Leaks in roof cladding: moisture source
	Poor perimeter ground drainage: moisture source
	Open shelter: inadequate shield from lateral rain penetration
Dissolution of earthen building materials	Leaks in roof cladding: moisture source
	Poor perimeter ground drainage: moisture source
	Open shelter: inadequate shield from lateral rain penetration

[1] For further details on the mechanisms of deterioration see the chapter by Curteis in this publication. See also Torraca (2009: 72–95).



FIGURE 4: The enormous roof over the Annex of Eustolios at Kourion, Cyprus, covers a span of some 35 m, but was designed without drainage. Improvised surface drainage was eventually created with ceramic pipes.

These design 'mistakes' or 'omissions' can have major consequences, such as inadequate management of rain and groundwater (Table 1). The height and extent of roof cover of an 'open' shelter, without lateral cladding, can fail to shield against lateral driving rain in shelters. Rainwater goods in the roof design are often insufficient to manage heavy rainfall, and water can be channelled to drains with inadequate capacity, or there is often a complete lack of drainage provision because of the archaeological sensitivity of the ground (Figure 4). As a consequence, roofs that should protect the ancient remains from rainwater actually collect it and funnel it to the perimeter ground, where it is readily absorbed and then redirected up into ancient building fabric by capillary means. Locally saturated ground can produce flood conditions in periods of heavy rainfall (Figures 5–7).

Large shelters consume vast capital resources in design and construction, which are usually procured by special financial measures. These never provide funding for subsequent maintenance, which is a substantial cost over time, and local budgets are usually insufficient to meet it.

Good maintenance of a shelter is essential for it to fulfil its protective role over ancient remains. The ability to carry out maintenance is closely related to the design of the shelter and its component materials. These often present obstacles to maintenance, rather than facilitate its execution. For example, high modern roofs without ease of access also prevent regular inspection and repair without expensive access equipment.

The selection of materials has huge implications on the ease and cost of maintenance, particularly with respect to durability in their local environment. Metal is often utilized either as exposed structural supports or reinforcement in concrete. In a marine environment, exposed metal requires very rigorous surface protection against ambient chloride salts from the sea, otherwise its eventual corrosion can jeopardize the stability of the structure (Figure 8). Iron is also at risk in poor-quality concrete.



FIGURE 5: The first generation of shelters at Kourion on the coast of Cyprus consisted of open shelters, whose height and span provided no protection for mosaics from raking sunlight or rain.





FIGURE 6: Mosaics of the coastal Villa Silin, Libya, in a semi-enclosed room which traps marine aerosols from the sea; they show active deterioration from chloride salts (see the chapter by El-Turki in this publication).

FIGURE 7: Water droplets on a marble floor, from holes in the shelter roof caused by corrosion of metal fasteners.

Current management of shelters

The poor management of most archaeological sites is reflected in the progressive deterioration of walls, decorative features, and rampant seasonal vegetation growth. It is also evident in the condition of shelters on some sites where even the most basic forms of maintenance do not occur, ultimately compromising the ancient remains they are intended to protect.

An underlying weakness of archaeological site management is that it is often poorly defined or under-skilled, and operating within a rigid organizational hierarchy. This prevents flexibility and creative use of limited resources. The result is that there is no clear assignment of responsibility at a local level, so even the most basic conservation problems are ignored. This is compounded by a poor understanding of basic maintenance practice, such as the costs of maintenance (personnel and materials), which is necessary to plan and implement a maintenance programme. The professional maintenance manager is a critical discipline needed at national and regional levels, but this role rarely exists in Mediterranean antiquities authorities.



FIGURE 8: The Villa of the Nereids, Tajurah, Libya, with its steel and wooden shelter erected after excavation in the 1960s. After decades of neglect, the structures are in a dangerous state of collapse from corrosion of the metal supports.

Evaluation and monitoring of existing shelters

Definition of evaluation and monitoring and their objectives

The objective of evaluation and monitoring is to determine the effectiveness of the shelter in protecting ancient remains over time, and ultimately improve its performance as required. Initial evaluation is a description of the environmental context of the ancient remains and shelter, their respective components, materials and their condition. Monitoring at regular intervals should then follow. This is to detect changes in condition of the ancient fabric and of the shelter, and to determine how it performs, such as in heavy storms.[2]

Issues related to evaluation and monitoring

Skills and competency: A broad range of multidisciplinary skill sets is needed to manage archaeological sites. These roles include site maintenance workers, restorers/technicians, the site manager (or equivalent), regional managers; all employed by the state. Private contractual services are usually architects, conservators and building contractors.

Site personnel who are present on a daily basis, such as maintenance workers, are usually poorly skilled, but with leadership they can be trained to effectively monitor site conditions and report back problems to their manager. They require an initial understanding of the causes of deterioration of ancient remains and defects in protective shelters in order to monitor a site effectively.[3] Indeed, the provision of good training on an archaeological site can nurture a sense of pride and empowerment expressed through care for the site by those that work there (Figure 9).

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[2] For more detail on the monitoring of existing shelters, see Getty Conservation Institute Historic England and Israel Antiquities Authority (forthcoming).

[3] For example, a basic understanding of mosaic deterioration is provided in Alberti, Bourguignon and Roby (2013).



FIGURE 9: Site managers training to read and record the condition of archaeological mosaics; similar initiatives are possible for all site personnel.

Professional skills of archaeologists, surveyors, architects and conservators are required to establish core documentation, and undertake preliminary evaluation of ancient remains and their associated shelter. Architects should be experienced in the conservation of archaeological sites in particular, as well as in the performance of modern buildings in general. After initial evaluation, and any subsequent conservation interventions, specialist professional skills are only required on an occasional basis.

Technical level of evaluation and monitoring (‘ideal’ monitoring vs. monitoring based on needs and available resources): Initial evaluation of shelters requires site inspection by architects and conservators, employing their own specialist powers of observation, supported with good written and graphic documentation. Sophisticated technologies, such as laser scanning of ancient surfaces, or real-time monitoring of environmental parameters, are not required except in rare cases of very significant ancient features subject to serious deterioration and loss.

Subsequent monitoring of shelters and ancient remains by site personnel is a matter of regular inspection and accurate recording of the location of problems. This requires literacy in map reading, and good powers of observation and organization.

Therefore, the vast majority of evaluation and monitoring activities ultimately rely on good but basic human faculties and simple technology (e.g. digital photography), and are not dependent on large budgets for specialist techniques or equipment.

Information management for evaluation and monitoring: Good conservation management requires appropriate methods to record and store information, which is critical for future evaluations. An effective method for data management is a site-wide geodatabase, a geographic information system (GIS) that permits the use of a multiplicity of spatial data (written, graphic, etc.) through data entry, handling, management, and search and analysis. Free software is available on the internet.

Such systems in the cultural heritage sector ideally emanate from a strategic national level to include all relevant components of the historic environment, and are managed around the country at regional and local levels to capture data from individual sites.[4]

Standardized recording forms for different purposes are essential, to ensure consistency of information gathered and its future interpretation. Hard copy survey sheets are most practical, as computer equipment can be fraught with problems on-site. Completed hard copy records are scanned and then filed electronically within the GIS database. The use of graphic glossaries is recommended as these provide consistency in the description of different types of deterioration and aid comprehension by future users. Such glossaries exist for deterioration of stone and mosaics (e.g. ICOMOS 2010, Getty Conservation Institute 2003).

Components and methods of evaluation and monitoring

Primary evaluation of archaeological sites and shelters: Evaluation of the performance of a shelter in protecting ancient remains requires a series of investigations both in archives and on-site, as described in detail in Table 2. The nature of this evaluation is complementary to that of environment monitoring (see the chapter by Curteis in this publication).

Part of this research is to identify base graphic documentation to be used for evaluation. Existing material is often poor, so a subsequent task is to commission and generate good survey documentation. The basic documentation required for evaluation and monitoring consists of good topographic plans of the site, its

TABLE 2: Evaluation tasks

ACTIVITY	TASK	PERSONNEL
1 Background research		
Site hydrogeology	Identify natural watercourses, drains (ancient and modern); history of flooding events	Archaeologist, historian, geologist
History of site interventions	Understand modifications that affect current conditions	Archaeologist, historian
Graphic documentation	Compile topographic plans, site and building plans for use in survey	Archaeologist, historian
2 Survey		
2.1 Measured survey		
Site topographical survey	Create base record for building evaluations (if none exists)	Surveyor
Rectified photography (ancient buildings/decorative features)	Create base record for condition surveying and monitoring (if none exists)	Surveyor
2.2 Condition survey		
Site	Describe topography, adjacent structures, site drainage	Conservation architect/ conservator
Shelter	Describe structure, cladding, apertures, rainwater goods, drainage	Conservation architect
Ancient (sheltered) remains	Describe structural walls and decorative features (mosaics, wall plaster etc.)	Conservation architect/ conservator

[4] For example, the *Arches: Heritage Inventory & Management System*. Arches is an open source software system that incorporates international standards and is built to inventory and help manage all types of immovable cultural heritage. It brings together a growing worldwide community of heritage professionals and IT specialists. Arches is freely available to download, customize, and independently implement from http://archesproject.org/. See also Letellier, Schmid and LeBlanc (2011).

buildings (ancient and modern), infrastructure (such as site drainage) and precise alpha or numeric identification labels.

Understanding patterns of water movement is critical in determining causes of deterioration, or risks in the event of heavy storms or flash flooding. These derive from several sources, and are influenced by local topography and levels that affect the flow of rain and floodwater:

- levels of natural topography, adjacent structures and the shelter, and their interconnection;
- natural watercourses and patterns of flooding and their frequency;
- human-made watercourses, both exposed and buried (ancient and modern).

Background historical research therefore needs to identify the location of watercourses (such as ancient and modern drains), historical flood events, etc. This also highlights areas of particular concern to be checked during evaluation and subsequent monitoring.

The sequence of tasks for an initial evaluation is defined in Table 2.

The output of initial evaluation is a condition report, which describes the site context, the ancient remains and their shelter, both in terms of their material composition and their condition. Specific forms of deterioration are plotted on plans, elevations and in photographs, as a form of 'condition mapping' (Figure 10). This are graded in terms of their severity and local risk.

The conservation architect and conservator need to distinguish between forms of deterioration affecting ancient remains caused by the shelter, and those produced by more general environmental conditions. The former are outlined in Table 1. A prioritized list of remedial works to stabilize ancient remains is then proposed, along with necessary repairs or modifications to the shelter.

Good photographs taken at this stage are crucial for future monitoring and re-evaluation, to compare changes in condition over time. High-resolution photography is sometimes needed to adequately record the condition of decorative surfaces (wall paintings, stucco or mosaics).

The evaluation can also generate a risk map (Figure 11), which identifies the location and level of specific risks (such as flooding). This can be used to prioritize and plan remedial works, or aid future monitoring.

Monitoring to assess change: The process of monitoring follows the recording and evaluation of a shelter and its associated ancient remains. Systematic monitoring is the inspection of particular building components on a regular basis, as well as after storm events, etc., to identify defects or problems so they can be addressed in a timely manner. In contrast, random visits are usually unable to detect changes before they result in major damage.

Monitoring should be carried out by site personnel at daily, weekly or monthly intervals (Table 3). In fact, personnel familiar with the site are the most important asset in monitoring. For example, their familiarity with seasonal weather variations, particularly in the flow of rain and seasonal floodwaters is powerful knowledge (and lacking in any conservation professionals who visit the site intermittently). Monitoring after rainfall is particularly useful to identify problematic areas of water management goods, and water pooling in sensitive areas.

Most shelter faults are initially minor. If identified through regular inspection they can be remedied with minimal resources. Typical examples are roof gutters blocked with natural debris, holes in roof cladding or blockage of land drains. Otherwise, it may mean restricting access pending the arrival of a conservation professional (e.g. unstable wall > restrict access > call in specialist to provide advice on emergency support).

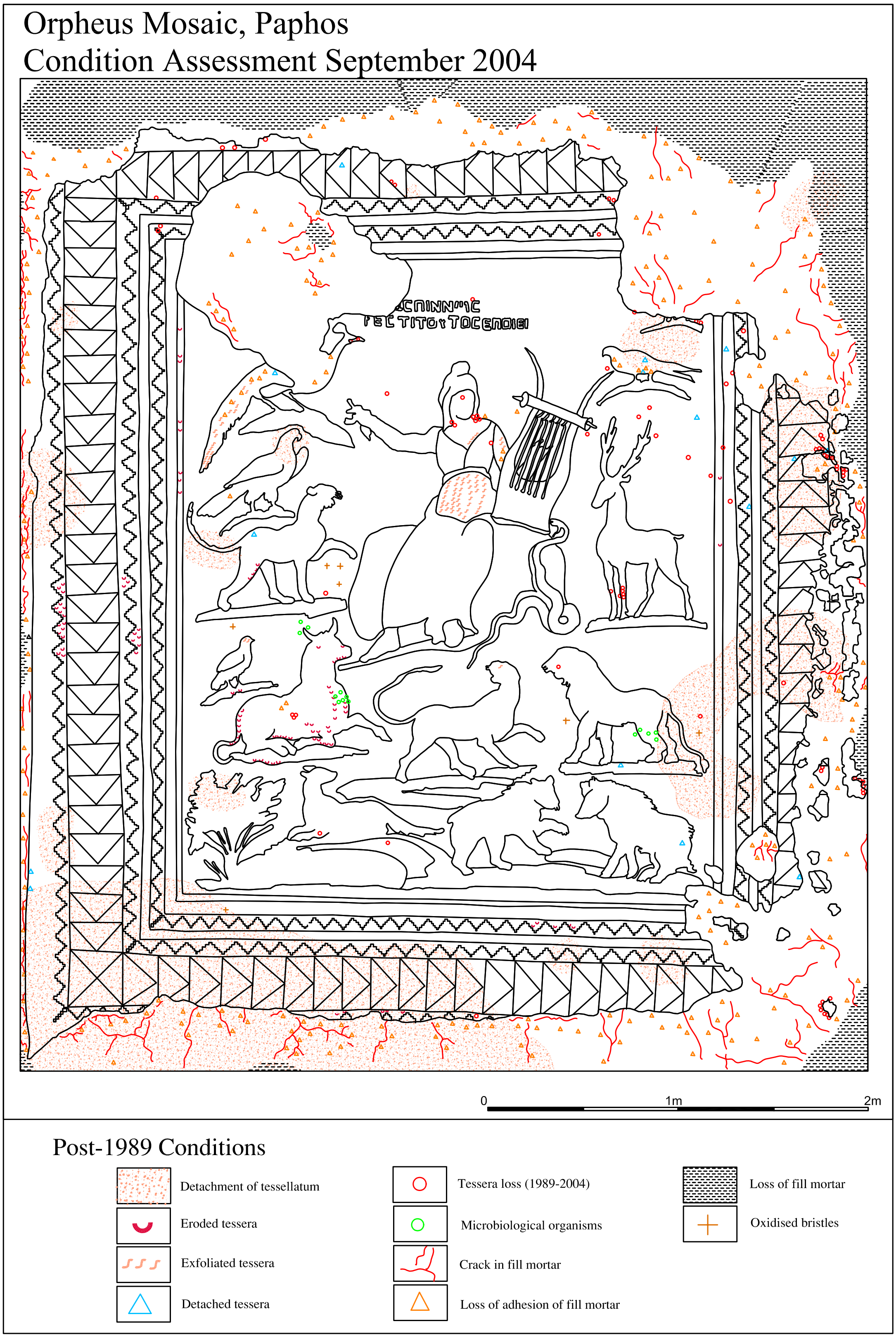
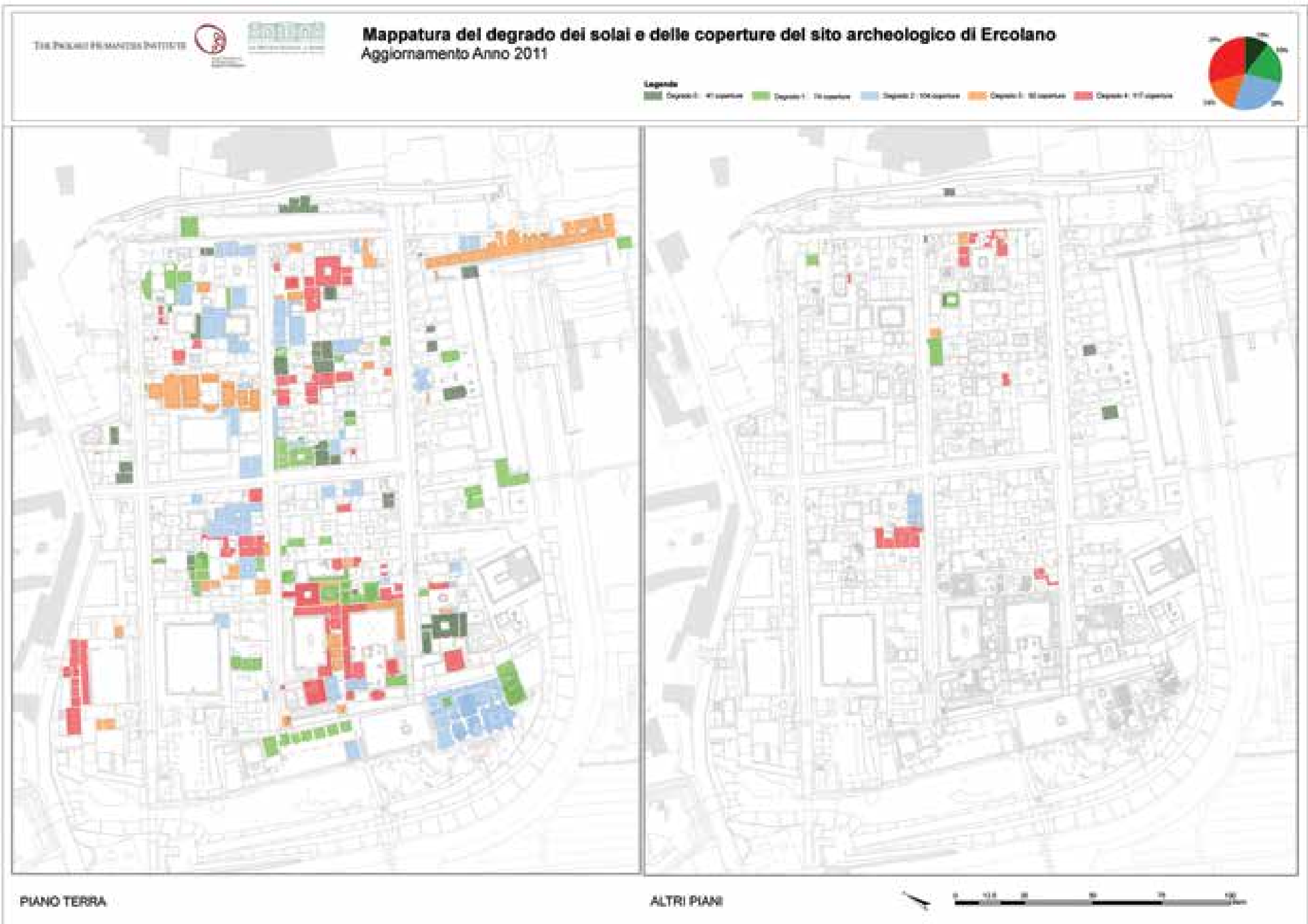


FIGURE 10: An example of condition mapping of a mosaic, showing a variety of defects, undertaken by the Getty Conservation Institute for the Orpheus Mosaic Conservation Project, Paphos, Cyprus.

Inspections should be carried out with logbooks, accompanied with site and/or building plans for accurate identification of problem areas. Photographs are useful to record these but they must be properly filed for long-term benefit.

Professional re-evaluation of shelters and ancient remains should be undertaken in conjunction with regular monitoring. This may mean an annual condition survey of ancient walls and surface decoration by a conservator. Every four or five years, shelters should be reviewed by a conservation architect as part of a national audit of the infrastructure of archaeological sites. These are intended to detect more serious issues with the relevant professional expertise. Only in rare circumstances would environmental monitoring be required (see the chapter by Curteis in this publication).

Table 3 on page 69 lists typical elements associated monitoring tasks, their frequency, and the type of inspector required.



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FIGURE 11: A map used for defining risks in Herculaneum, generated by the site's GIS (see the chapter by Pesaresi and Massari in this publication). This map focuses particularly on risks in relation to shelters. The level of risk defines the type of risk, for example, Level 1 (*Degrado* 1) means that there are no specific risks but nor is there any ongoing maintenance, a Level 2 risk (*Degrado* 2) indicates where the shelter's rainwater drainage system is blocked. Using the GIS, this map can be cross-referenced with another that identifies the features of each shelter. This enables site staff to define the risk in greater detail. For example, blockages in gutters on a provisional shelter can be easily removed and do not present a serious risk but blockages within a drainpipe leading from a flat-roofed shelter bring a significantly increased risk of flooding and water ingress. The risk maps are also evaluated in conjunction with maps created to identify archaeological remains and conservation needs. This can help the site manager to understand where resources may need to be targeted. The technology of the GIS means that the process of generating and comparing these risk maps is rapid.

TABLE 3: Monitoring checklist[5]

ELEMENT	MONITORING TASK	INSPECTOR
After storm weather		
Roof areas and rainwater goods generally	Inspect coverings and flashing from ground level	Site personnel
Surface water drainage channels and gullies	Inspect and note if ineffective or blocked	Site personnel
Interior	Inspect for water pooling, debris and collapse	Site personnel
Daily		
Building elements generally	Note loose or detached items	Site personnel
Building envelope	Note real or attempted security breaches	Site personnel
Weekly		
Surface water drainage channels and gullies	Check for vegetation and debris from May to November	Site personnel
Monthly		
Roof areas and rainwater goods generally	Inspect for leaks or other defects	Site personnel
Interior ancient walls	Check for instability or recent collapse	Site personnel
Interior mosaics	Photograph details of areas of concern	Site personnel
Interior wall plaster	Photograph details of areas of concern	Site personnel
Twice yearly		
Roofs: rainwater goods	Engage a contractor to check for cracks or leaks, check that water is discharging properly into drains	Building contractor
Drains: surface water drainage, gullies, below-ground drains	Engage a contractor to open up inspection chambers; check that all gullies and gratings are free from debris, and that water discharges freely into drains	Building contractor
Yearly: external fabric		
Roof: cladding, flashings and gutters	Engage a contractor to inspect for defects such as holes, weathering, etc.	Building contractor
Cladding	Engage a contractor to inspect for defects such as holes, weathering, etc.	Building contractor
Glazing	Inspect for defects	Building contractor
Surface finishes	Inspect for defects	Building contractor
Yearly: internal fabric		
Internal structure and fabric generally	Inspect for defects	Building contractor
Solid floors/walkways	Inspect for defects	Building contractor
Barriers	Inspect for defects	Building contractor
Interior ancient walls	Check for instability or recent collapse	Conservator
Interior mosaics	Photograph details of areas of concern	Conservator
Interior wall plaster	Photograph details of areas of concern	Conservator
Yearly: building services		
Lightning protection	Engage a specialist contractor to inspect	Specialist contractor
Electrical systems	Engage a specialist contractor to inspect	Specialist contractor
Heating and boiler systems	Engage a specialist contractor to inspect	Specialist contractor
Fire extinguisher system	Engage a specialist contractor to inspect	Specialist contractor
Intruder alarm system	Engage a specialist contractor to inspect	Specialist contractor
Every 4–5 years		
All elements of building fabric		Conservation architect

[5] Adapted from McCaig (2013).

Maintenance mechanisms for improving and restoring shelters

The importance of maintenance for shelters in archaeological sites

Just as for modern buildings in towns, the maintenance of shelters on archaeological sites is crucial to ensure their continued effectiveness over time and to mitigate any risk that the shelters themselves cause damage to archaeological remains. What makes maintenance of shelters particularly critical in archaeological contexts arises from the challenges and contradictions discussed above. The specificity of the location and structure of shelters,[6] as well as the building restrictions that are required to adapt them to the particular conditions of the site and surrounding environment, and the difficulties of direct access are all factors which have a bearing on the efficiency of shelters and, consequently, on their maintenance needs (Figure 12).

Maintenance of the shelters in the long term has a significant impact on the economic and intellectual resources that the site has available. For this reason detailed assessment is needed, which should take into account objectives, possible methodologies, cost versus available resources and opportunities for improvement (e.g. accessibility), to create a sustainable and efficient maintenance programme (Pesaresi and Rizzi 2007).

The challenge of 'designing' maintenance can often prevent maintenance actually being carried out. A significant factor in this is the limited amount of economic resources that can be guaranteed over time. Availability of resources (financial and human) needs to be factored into the design process so that the maintenance programme put in place is viable. A clear understanding of the availability of resources will also inform further conservation decisions on the same site.

In cases where resources are reduced to the bare minimum, monitoring of the condition of the shelter can be carried out as the simplest form of maintenance, but this should only be considered as a short- to medium-term option, and always combined with small practical interventions (e.g. placing a protective sheet on the ground where rainwater is collected



FIGURE 12: Shelter in the archaeological area of Aksum, Ethiopia.

[6] Shelters may be built as isolated or partial structures but they are always built on top of archaeologically sensitive areas; this creates challenges related to precisely where supports can rest on archaeology, where foundations can be dug or where water can be drained, etc.



FIGURE 13: Maintenance of a shelter in Herculaneum, Italy (see the chapter by Pesaresi and Massari in this publication).

incorrectly). In cases where there is a chronic shortage of resources the site manager may decide to adopt more radical measures to preserve the archaeological remains, for example through reburial.

The importance of addressing maintenance issues applies equally to the so-called 'temporary' or 'provisional' shelters. In most cases these are installed as a knee-jerk response to an emergency or sudden influx of capital funding, without any consideration of their function in the long term. As a result, this type of shelter often remains in place for extended periods of time. If no plans are put in place to replace it with a permanent shelter such temporary structures can remain for years, even until they collapse. Regular, appropriate maintenance is therefore essential to maximize the efficiency of temporary shelters, until such time as they can be replaced. The process of maintenance may also provide the site manager with understanding and information about the shelter that can feed into the design of a permanent solution (Figure 13).

Programming and planning maintenance (Figure 14)

As discussed above, the design stage is a critical moment to ensure that the requirements of the shelter structure are clearly considered and understood. The design must, therefore, include a detailed maintenance plan for its lifetime, which should be extended to incorporate at least the adjacent areas in order to include the shelter's water drainage system. In the case of an existing shelter for which a maintenance schedule has not previously been put in place, the evaluation phase, as described above, can provide the basis for designing, planning and implementing such a programme.

An essential feature to consider when designing a shelter, and which underpins its future maintenance programme, is its expected lifespan. At the outset, an 'end date' must be identified and agreed, i.e. when the shelter must be dismantled or replaced.

With this end date established as the key outcome for the process, the consideration of maintenance needs and resources during the planning phase of a new shelter can profoundly influence technical and typological options. They may even influence the decision as to whether or not to proceed with construction at all. For example, in the case of an evaluation (feasibility study/preliminary design stage) for a temporary shelter, the financial forecasts for *post operam* maintenance costs (which are generally higher than those for a permanent shelter) may point towards the construction of a permanent shelter as being a more sustainable solution instead (Figure 15).

The maintenance programme of a shelter must take into account:

- regulatory issues/current safety requirements;
- the availability of human and economic resources in the long term;
- visitor requirements (in the case of public access);
- accessibility;
- climatic and environmental factors;
- site management issues;
- the need for effective information management systems;
- financial requirements: these should match funding that is actually available and not be tied to specific capital funding or budget extensions that are not yet approved.

Shelter maintenance requires regular assessment *post operam*. Assessment will consider the shelter's effectiveness, the actual costs of maintaining it, and any difficulties or challenges that are being encountered when maintenance is carried out. This assessment will then inform recommendations for corrections or further improvements to be made to the structure.

Regular assessment should therefore be incorporated into the maintenance programme. The scope of assessment should not be limited to the shelter but must include the archaeological remains that it protects and the context of the wider site's needs. For this reason it is essential that the maintenance programme includes clear procedures to record and store information and data on a regular basis. This information will enable the site manager to evaluate the cost-efficiency of the shelter's performance and budget maintenance costs effectively over the lifetime of the shelter.

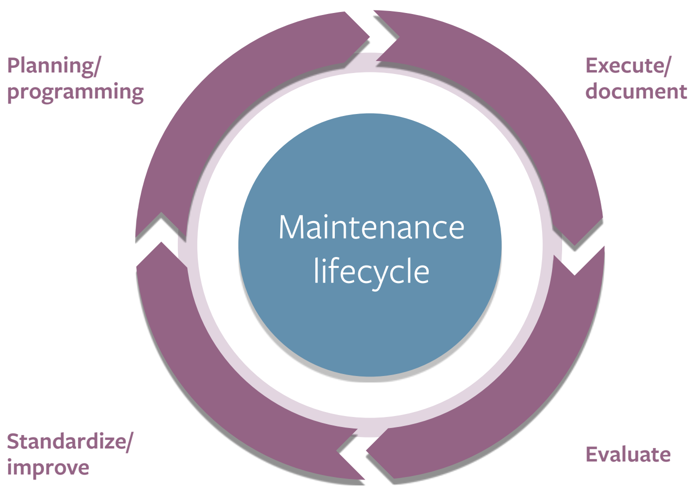


FIGURE 14: The 'virtuous circle' of maintenance: the process starts with an appropriate planning of the maintenance, followed by the execution of the maintenance and proper documentation practices. This enables post operam assessment/re-evaluation to improve the shelter and standardize maintenance operations and procedures. At the end of the cycle, a new planning phase will take into account the improvements made to the shelter and will accommodate the standards already defined. The appropriate use of the maintenance cycle will result in extending the life of a shelter and in minimizing the level of resources needed for its maintenance.





FIGURE 15: A provisional shelter over the Villa of the Papyri, Herculaneum. The supporting structure is built using scaffolding props, the joints of which must be inspected every six months under Italian law. This means the cost of maintenance is extremely high and difficult to carry out, creating significant responsibilities for the site manager.

On the one hand, the time needed to construct a shelter is generally short and building it can be a simple procedure. On the other hand, the time required for the maintenance of the built shelter is substantial; with maintenance being a long-term commitment this presents not inconsiderable difficulties in its programming. Maintenance should therefore be planned on a cyclical basis; either on an annual, or preferably, multi-annual basis (Pesaresi 2013). The plan should allow for periodic audits and be sufficiently flexible to enable swift response to extraordinary events, such as those caused by storm weather (which can lead to the need for 'corrective' maintenance), now a frequent occurrence. In addition, this flexibility enables the site manager to respond appropriately to unexpected budget adjustments, whether these be increases or cuts.

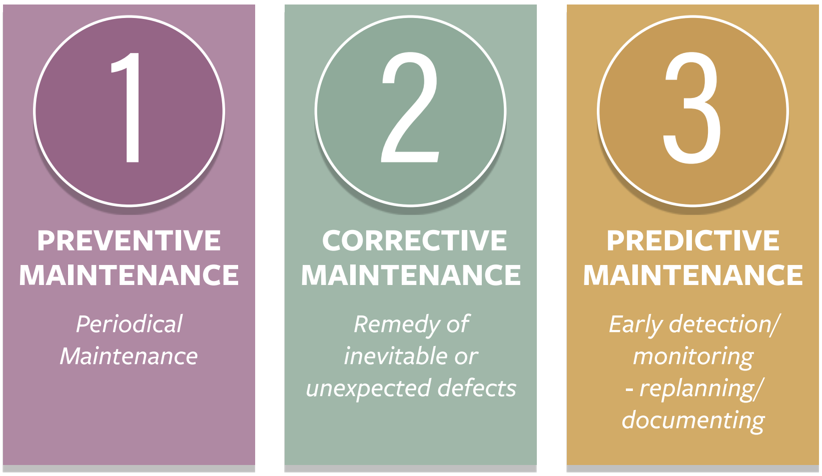
Lastly, the maintenance plan should incorporate forms of systematic monitoring. This can be general (as indicated in Table 3 above) or more specific, such as recording the results of periodic analysis. The monitoring procedures adopted must always be in line with available resources. For these reasons it is advisable that shelter maintenance is embedded alongside other site-maintenance operations as part of a regular site-wide programme of activity.

Methodology in the maintenance and monitoring of existing shelters

(Figure 16)

The majority of maintenance tasks carried out during the 'life' of a shelter are routine and straightforward. These tasks have two objectives: 1) to maintain the functionality of the shelter, and 2) to prevent possible faults occurring. Therefore, a well-organized and cyclical maintenance programme should focus on preventive activities; their purpose being to maximise the operational life of a shelter and ensure that it continues to perform its task efficiently. This becomes particularly significant if, for financial reasons or otherwise, the shelter is required to remain *in situ* for longer than originally intended.

Preventive maintenance tasks will have precautionary and recurrent characteristics. They will be defined according to factors such as 'seasonality' or to the particular characteristics of the material and technology used for the shelter's structure (Figure 17). As noted already, shelters on archaeological sites may demonstrate fundamental defects as a result of constraints within their design. This is especially true for the shelters that were constructed *ad identicum* across many Mediterranean sites during the twentieth century. In particular, the use of certain materials and technologies such as reinforced concrete, timber framing and untreated metals can, over time, require constant maintenance for the long term, for example in cases where removing the structure entirely is not always an option (Figure 18).



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FIGURE 16: In engineering there are three different categories of maintenance activities, defined as: 1) preventive, 2) corrective and 3) predictive. This classification and the consequent multiple sub-groupings within each category can be applied equally to shelters and used to classify the maintenance needs of most of the architectural features present within an archaeological site.

Where structural deterioration is particularly advanced but not so much as to require a total replacement of the shelter (or replacement of the shelter is not possible for financial reasons or because the shelter itself now has heritage values), maintenance can focus more on applying *corrective* measures. This type of maintenance implies the partial replacement of elements of the shelter or even fairly substantial changes. The aim of such measures is to extend its functional life and minimize maintenance costs over the long term (Figure 19).

Corrective measures may also be necessary in the case of unexpected failure of the shelter structure (e.g. as the result of an extreme weather event). The requirements of a corrective maintenance regime can be costly and demanding, although they help to keep the most serious risks under control. These risks can include partial or total collapse of the shelter and damage to adjacent archaeological structures (Van Balen and Vandesande 2013). Where shelters demonstrate structural defects that render preventive maintenance efforts ineffective or complex and too expensive, corrective actions may be undertaken.

Such remedial interventions should, where possible, be integrated into the same maintenance programme, so as to take advantage of the logistics and administrative context of the site.

As discussed above, monitoring provides a rudimentary form of maintenance, carried out through general inspection (Table 3) and through specific checks, e.g. analysis of the shelter's built materials to assess their state of decay, which may identify a need for subsequent specialist intervention. These results, which are ideally collected and entered into a database (such as a site-wide GIS), can be used in association with other data to detect early on where shelters may fail.

Effective information management should include documentation of maintenance operations, in order to highlight any possible need to modify a shelter's structure. Again, the use of a GIS facilitates the site manager's ability to keep track of costs and procedures and to record any problems encountered in carrying out shelter maintenance. With this information a simple system of *predictive* maintenance can be created, aiding the site manager in defining future needs and allocating available resources more efficiently.

The results of technical assessments, along with the systematic monitoring, contribute directly to the maintenance programme. In this way a 'virtuous circle' of maintenance is created, rendering it evermore effective and reducing maintenance requirements overall (Figures 20–21).



FIGURE 17: An example of preventive maintenance on a floor slab that serves as a shelter for the room below in Herculaneum: this includes removing dust and vegetation, and sealing gaps between the external wall and the waterproof layer (see the chapter by Pesaresi and Massari in this publication).

FIGURE 18 (below): Herculaneum: a shelter built in the early 1930s. The shelter's supporting structure also incorporates fragile carbonized wooden panels belonging to the original ceiling. Substituting the entire structure is therefore not an option and a complex intervention of partial substitution/replacement is necessary (see the chapter by Pesaresi and Massari in this publication).





FIGURE 19 (above): An example of corrective maintenance on an *ad identicum* shelter in Herculaneum: replacement of some of the wooden beams and modification of the system used to channel rainwater away (see the chapter by Pesaresi and Massari in this publication).

Designing and redesigning shelters to reduce maintenance needs

When designing a shelter, the implications for its future maintenance must be carefully considered in order to identify needs (e.g. accessibility), constraints (e.g. safety implications), costs, and so on.

As explained above, the choice of materials used to build a shelter has direct implications for the ease and cost of maintenance. This is particularly relevant when considering the resilience and durability of materials. The criteria for selecting the right building materials will include technological features related to the functionality of the shelter and the archaeological remains that are being protected. However, the designer must also take into account the intrinsic qualities of the material to be used and its durability within the particular environmental context of the archaeological site. This is an example of how future maintenance needs (and their costs) play a key factor in decision-making from the outset.

Where a more traditional or vernacular design of shelter is favoured, the choice of materials and technologies to be used should take into account how materials are sourced. Ideally

materials will be sourced locally, within the region where the archaeological site is located. This means that supplies are easily available when changes, replacements and maintenance are undertaken, which is especially important in the case of timber shelter structures and their treatment. Furthermore, it promotes the use of local resources and skills.

Specific procedures should be put in place for checking building materials for persistent deterioration. This is especially important if the material plays an important structural function for the shelter. In the case of timber, simple tools such as electric hygrometers can evaluate internal humidity levels over time, while the deterioration of the wood can be easily measured with minimally invasive instruments (e.g. a resistance drill). For example, if the shelter frame is to be made of timber (e.g. for historical or aesthetic reasons or to ensure greater compatibility with the original structures), the choice of wood type will play a crucial role in ensuring its durability and resistance to attack from insects or fungus. Ideally a hardwood will be used. In the case that a softwood must be used, for economic or logistical reasons, then regular treatment of the timber elements that may be exposed directly or indirectly to water can provide a satisfactory solution to protect them. However, the effectiveness of the treatment in providing protection over time must be assessed continually so that repeat treatments can be programmed when necessary (Figure 22).

A1 STRUTTURE DI COPERTURA	
Oggetto:	**copertura inclinata**
Codice tipologia:	**Tipologia**
CI(a)	orditura lignea, coppi e embrici
CI(c)	orditura in c.a., coppi eembrici
CI(b)	orditura mista in c.a. e legno, coppi e embrici
Oggetto:	**copertura parziale**
Codice tipologia:	**Tipologia**
CPa(c)	pensilina e lastre
CPa(b)	pensilina e lamiera grecata
CPa(a)	pensilina e manto in tegole
CPa(d)	lucernai
Oggetto:	**copertura provvisoria**
Codice tipologia:	**Tipologia**
CPr(c)	trasparente
CPr(a)	lastre multistrato
CPr(d)	grecata
CPr(e)	sperimentale trasparente
CPr(b)	sperimentale a struttura lignea
Oggetto:	**copertura voltata**
Codice tipologia:	**Tipologia**
CV(d)	voltata con massetto cementizio
CV(b)	voltata con guaina
CV(e)	voltata con manto in tegole
CV(c)	voltata con asfalto
CV(a)	voltata con massetto in cocciopesto
Oggetto:	**solaio piano**
Codice tipologia:	**Tipologia**
SP(n)	putrelle, assito ligneo, massetto e guaina
SP(i)	cemento armato, massetto e asfalto minerale
SP(b)	struttura lignea, massetto e porzioni antiche
SP(g)	cemento armato, massetto e guaina
SP(h)	struttura lacerocementizia, massetto e guaina
SP(d)	struttura lignea, massetto e asfalto minerale
SP(m)	putrelle, assito ligneo e massetto in cocciopesto
SP(o)	putrelle, assito ligneo, massetto e asfalto minerale
SP(f)	struttura laterocementizia e massetto in cocciopesto
SP(e)	cemento armato e massetto in cocciopesto
SP(a)	struttura lignea e massetto
SP(c)	struttura lignea, massetto e guaina
SP(l)	struttura lacerocementizia, massetto e asfalto minerale

A2 STRUTTURE IN MURATURA	
Oggetto:	**cantonale**
Codice tipologia:	**Tipologia**
CAN(b)	laterizio
CAN(a)	tufo
CAN(c)	opus vittatum mixtum
Oggetto:	**colonna**
Codice tipologia:	**Tipologia**
COL(b)	laterizio
COL(c)	opus vittatum mixtum
COL(a)	tufo
Oggetto:	**cresta muraria**
Codice tipologia:	**Tipologia**
CM(c)	bauletto
CM(d)	copertina di malta
CM(e)	assenza di protezione
CM(b)	tegole
CM(a)	imitazione nucleo
Oggetto:	**graticcio**
Codice tipologia:	**Tipologia**
G(a)	opus reticulatum
G(b)	opus incertum
Oggetto:	**muratura controterra**
Codice tipologia:	**Tipologia**
MC(d)	opus vittatum mixtum
MC(c)	opus vittatum
MC(b)	opus incertum
MC(a)	opus reticulatum
Oggetto:	**paramento**
Codice tipologia:	**Tipologia**
PRM(a)	opus reticulatum
PRM(c)	opus vittatum
PRM(d)	opus vittatum mixtum
PRM(b)	opus incertum
Oggetto:	**pilastro/semipilastro**
Codice tipologia:	**Tipologia**
P/S(b)	laterizio
P/S(c)	opus vittatum mixtum
P/S(a)	tufo
Oggetto:	**volta/arco**
Codice tipologia:	**Tipologia**
V(e)	a vela
V(d)	a crociera
V(c)	a botte
V(a)	a tutto sesto
V(f)	a padiglione
V(b)	a sesto ribassato
A3 ELEMENTI DI CHIUSURA	
Oggetto:	**cancelletto apribile**
Codice tipologia:	**Tipologia**
CA(a)	legno
CA(b)	metallo
CA(c)	legno e metallo
Oggetto:	**cancelletto fisso**
Codice tipologia:	**Tipologia**
CF(a)	legno
CF(c)	legno e metallo
CF(b)	metallo
Oggetto:	**corda**
Codice tipologia:	**Tipologia**
C(c)	corda con paletti in legno
C(b)	corda con paletti in metallo
C(a)	corda e ancoraggi
Oggetto:	**porta**
Codice tipologia:	**Tipologia**
POR(d)	legno e vetro
POR(b)	metallo
POR(a)	legno
POR(c)	legno e metallo

A4 ARCHITRAVI	
Oggetto:	**architrave**
Codice tipologia:	**Tipologia**
PTT	piattabanda in tufo
L	lamellare/legno giuntato/legno massello
PI	putrelle rivestite intonaco
PL	putrelle rivestite legno
CA	cemento armato
PTL	piattabanda in laterizio
A5 ELEMENTI PROVVISIONALI	
Oggetto:	**parapetto temporaneo**
Codice tipologia:	**Tipologia**
PT(a)	tubo-giunto
PT(b)	tubo-giunto e rete
Oggetto:	**ponteggio/castelletto**
Codice tipologia:	**Tipologia**
P/C(a)	tubo-giunto
P/C(b)	tubo-giunto con rivestimento in tavole lignee
Oggetto:	**puntellatura elemento**
Codice tipologia:	**Tipologia**
PE(b)	in legno
PE(a)	in tubo-giunto
Oggetto:	**puntellatura sup. orizzontali**
Codice tipologia:	**Tipologia**
PO(a)	in tubo-giunto
PO(b)	in legno
Oggetto:	**puntellatura sup. verticali**
Codice tipologia:	**Tipologia**
PV(a)	in tubo-giunto
PV(b)	in legno
Oggetto:	**recinzione**
Codice tipologia:	**Tipologia**
RTG(b)	tubo-giunto e rete
RTG(a)	tubo-giunto
A6 TECHE/ESPOSITORI	
Oggetto:	**lastra di protezione in vetro**
Codice tipologia:	**Tipologia**
LV(a)	infisso apribile Maiuri
LV(b)	lastra fissa su zanche Maiuri
Oggetto:	**lastra protezione in plastica/plexiglass**
Codice tipologia:	**Tipologia**
Lp(a)	infisso apribile
Lp(b)	lastra fissa su zanche
Oggetto:	**quadretto**
Codice tipologia:	**Tipologia**
Q(a)	cornice in legno e vetro
Oggetto:	**teca in ferro e vetro**
Codice tipologia:	**Tipologia**
T(a)	teca mobile Maiuri
T(b)	teca fissa Maiuri

A7 CORNICI E CORDOLI	
Oggetto:	**cornice**
Codice tipologia:	**Tipologia**
Co(a)	in pietra
Co(b)	in stucco
A8 ELEMENTI DI PROTEZIONE/ SICUREZZA	
Oggetto:	**linea vita**
Codice tipologia:	**Tipologia**
LNV(a)	in acciao
Oggetto:	**parapetto**
Codice tipologia:	**Tipologia**
PAR(b)	legno
PAR(a)	metallo
Oggetto:	**recinzione**
Codice tipologia:	**Tipologia**
REC(b)	legno
REC(a)	metallo
REC(c)	legno e rete metallica
A9 MARCIAPIEDI	
Oggetto:	**marciapiede**
Codice tipologia:	**Tipologia**
MAR(a)	cocciopesto
A10 SCALE DI SERVIZIO	
Oggetto:	**scala**
Codice tipologia:	**Tipologia**
SCL(a)	metallo
A11 SCARPATE	
Oggetto:	**scarpata**
Codice tipologia:	**Tipologia**
SCA(b)	a vista
SCA(a)	con muro controterra
A12 DISSUASORI ANTIVOLATILI	
Oggetto:	**dissuasore antivolatili**
Codice tipologia:	**Tipologia**
DIS(c)	rete antipiccione
DIS(b)	a filo ballerino
DIS(a)	a spillo

FIGURE 20: This list shows the architectural elements of the Herculaneum site that fall under the site maintenance programme (see the chapter by Pesaresi and Massari in this publication). Each element is characterized and allocated a code that refers to the specific intervention required (see Figure 21). As in the case of shelters, the characteristics particular to each typology are considered and this influences how the preventive/corrective/predictive maintenance is carried out.



MANUTENZIONE PREVENTIVA - SCHEDA INTERVENTO N. CI_int(a)_1

COPERTURA INCLINATA CON ORDITURA LIGNEA, COPPI E EMBRICI
- INTRADOSSO -

DESCRIZIONE INTERVENTO:

Intervento di minima finalizzato al mantenimento dell'integrità e alla resa estetica delle travi in legno che costituiscono sia l'orditura principale che quella secondaria della copertura. Si prevede la pulizia e la carteggiatura, l'eventuale rimozione di precedenti verniciature, il trattamento antitarlo con permetrina e la finitura con impregnante o vernice protettiva, a seconda dell'effetto da dare alla struttura (legno grezzo o legno carbonizzato). Completa l'intervento la revisione dei dissuasori antivolatili.

Durabilità prevista dell'intervento: 2 anni

ATTREZZI OCCORRENTI:

Pennelli, spatola, spazzola dura tipo nylon, spugne, carta vetrata varie grammature, guanti, mascherine di protezione.

MATERIALI OCCORRENTI - SPECIFICHE ED UTILIZZO:

MATERIALE	QUANTITA'	SPECIFICHE	PROCEDURA DI UTILIZZO
Sverniciatore universale	350ml/mq	Utilizzato per una profonda azione di rimozione degli strati di pittura, di vernice, di impregnante, di intonaco, di colla, di mastice su tutti i tipi di superficie: legno, metallo, piastrelle, vetro ecc. Non indicato per la rimozione di rivestimenti a due componenti.	Applicare uno strato spesso e regolare (2 - 3 mm) con un pennello (quantità 0,5 l/mq); lasciare agire da 3 a 30 minuti, a seconda del numero di strati da sverniciare; quindi asportare il rivestimento che si è ammorbidito, con una spatola o un raschietto. Sciacquare la superficie sverniciata con una spazzola dura (tipo nylon) ed acqua tiepida. Lasciare asciugare per 24 ore prima di applicare una nuova finitura. Ove sia possibile, applicare lo sverniciatore sul supporto posto orizzontalmente, per favorire la penetrazione del prodotto.
A_Permetrina + B_Essenza di trementina	Soluzione A+B: 150ml/mq	*Permetrina:* soluzione antitarlo efficace contro gli insetti xilofagi e non tossica per l'uomo, da diluire prima di ogni utilizzo. In base alle caratteristiche dell'oggetto da trattare e del lavoro da eseguire, come solvente si può utilizzare anche olio paglierino, acetone, ragia minerale, diluente nitro,	Diluire *la permetrina e l'essenza di trementina* in rapporto 1:49 (es. 100 ml di permetrina in 5 litri di solvente) e agitare bene. Distribuire il prodotto a pennello, o a iniezione, a spruzzo, per immersione o impregnazione sotto vuoto. Dosaggio: per trattamenti preventivi è sufficiente 150 ml di soluzione per mq.
		alcool etilico 99,9%, isopropilico, benzine, xilolo, toluolo. Il prodotto non è compatibile con l'acqua. *Essenza di trementina:* solvente vegetale ottenuto dalla distillazione delle parti resinose di alcune conifere, utilizzato per la diluizione di smalti sintetici e oleosintetici, di colori ad olio, cere, per la pulizia da oli e grassi.	
Stucco per legno	50ml/mq	Stucco in pasta a rasare di facile applicazione. Prodotto inodore, non tossico, non infiammabile e non nocivo.	Prodotto pronto all'uso, da mescolare prima dell'utilizzo. Applicare con spatole di acciaio flessibili.
Mordente per legno oppure	250ml/mq	Prodotto per la protezione del legno dall'azione degli agenti atmosferici e da muffe e marcescenze. Penetra in profondità nel legno e lo nutre. Non forma pellicola a non screpola.	Dopo l'eventuale sverniciatura, preparare il supporto pulendo la superficie da polvere e sporco, e carteggiare per renderla liscia. Mescolare il prodotto e applicarlo in due mani, a pennello o a spruzzo. Prima dell'applicazione della seconda mano, carteggiare leggermente la superficie con carta vetrata fine.
Vernice a smalto RAL 8019	150ml/mq	Smalto brillante a base di resine alchidica e siliconica, per applicazioni all'esterno. Dotato di elevata impermeabilità all'acqua.	Preparare il supporto mediante carteggiatura e/o sabbiatura. Applicare il prodotto in due mani a pennello o a spruzzo.

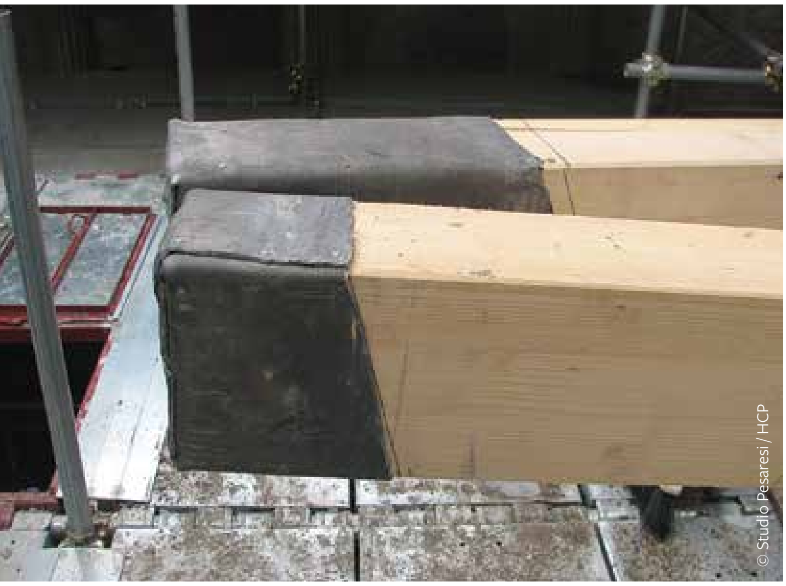
FASI DI INTERVENTO:

	PROCEDURA GENERALE	IMMAGINI INTERVENTO
Pulizia e sverniciatura	Rimuovere i residui di vernice o di precedente mordente applicando lo sverniciatore con un pennello, stendendone uno strato piuttosto abbondante sulla superficie da trattare. Attendere che la vernice si sia parzialmente staccata dal legno e rimuoverla con una spatola metallica. In caso di vernici molto resistenti o applicate a più strati, ripetere la procedura una seconda volta. Eliminare i residui con la carteggiatura, rendendo la superficie liscia a levigata.	
Trattamento antitarlo	Distribuire a pennello e per impregnazione la miscela a base di permetrina concentrata diluita in essenza di trementina; per legno lasciato a vista, diluire la permetrina anche nel mordente color castagno.	
Stuccatura	Riparare graffi e piccole mancanze con stucco per legno, applicabile tramite spatola.	
Trattamento impregnante/tinteggiatura	Procedere all'impregnazione con mordente tonalità castagno, applicandolo a pennello in due mani. In alternativa, procedere alla verniciatura a smalto RAL 8019 in due mani.	
Revisione dissuasori	Controllare la stabilità dei dissuasori, ed eventualmente procedere a punti di fissaggio con malta di calce idraulica.	

IMMAGINI:
copertura inclinata con orditura lignea e manto in coppi ed embrici su cui eseguire interventi di manutenzione preventiva

© Studio Pesares

FIGURE 21: An example of a guidance document that sets out the preventive maintenance intervention to be carried out on a shelter in Herculaneum (see the chapter by Pesaresi and Massari in this publication). The code assigned to the shelter corresponds to a precise description of the intervention required on that shelter and a necessary timeframe in which to repeat the maintenance (in this case the intervention is expected to remain effective for two years).





Accessibility is another critical factor to consider at the design stage. This may include features such as access to the top of the shelter, incorporating a safe system of access ladders and walkways, etc. If no direct access to the roof of the shelter is provided for, then even introducing certain basic elements that will need maintenance, such as gutters, must be carefully considered. For example, if an entire scaffold has to be built in order to clean out seasonal leaf-fall from the gutters, this will have significant cost and resource implications for site management.

FIGURE 22 (above left): Softwood beams with a layer of lead to protect them from humidity once fixed into the wall.

FIGURE 23 (above right): Maintenance of a wall and shelter in Herculaneum using an aerial platform.

Archaeological sites rarely have an internal road network that allows vehicle access. An assessment of the extra work and cost required to provide access to a shelter becomes crucial to ensure that maintenance can be carried out adequately and within a limited budget (Figure 23).

The effectiveness of a shelter can only really be measured over time. Therefore, if its performance is later determined to be ineffective it may become necessary to revisit the design of the shelter; perhaps modify drainage systems, amend construction elements or even change materials. For this reason, all possibilities for modification requirements and redesign must be identified and examined at the design phase to ensure that the prerequisite conditions for replacing, modifying and introducing elements are met. Through careful choice of technologies and materials even a temporary shelter can, in future, be enlarged, improved or even made permanent (Figure 24).

Definition of roles, responsibilities and actions

Managers of individual sites cannot expect to influence or change the organizational structure of their respective national heritage authorities in respect to conservation approaches. They can, nevertheless, distinguish the specific components of local maintenance programmes on-site and work proactively to achieve good outcomes or improve on them. Many basic maintenance tasks can be achieved through good observation, planning and the effective mobilization of existing personnel and financial resources. The role of site manager is key in the decision-making process relating to shelter maintenance and through effective leadership can address two principal risks that threaten the lifespan of a shelter: 1) a lack of multidisciplinarity and collaboration in the maintenance process; and 2) short-term planning and approaches.

If a broad range of skills is needed for the design and construction of a shelter on an archaeological site, so too are they required for its ongoing maintenance. Specialist knowledge is essential for planning and maintaining the shelter but further professional expertise is needed to understand the archaeological remains that must be protected. A multidisciplinary skillset that is framed within a teamworking approach provides a fundamental basis on which to establish the level of resources and type of approach to shelter maintenance that is required in each case.

FIGURE 24: In Herculaneum a provisional shelter is secured to wooden joists that will eventually support a permanent flat roof. This ensures immediate protection. In addition, since specific beams are supporting the weight of the temporary roof, the scaffolding props can be moved or removed as necessary to allow the space required to build the permanent roof over time (see the chapter by Pesaresi and Massari in this publication).



It is also essential that the multidisciplinary skills that are required at the design phase are engaged in the planning of the maintenance process and the longer-term ongoing monitoring and evaluation. This will ensure coherency and consistency in the method of observations and appraisal over time. For example, while structural engineers are often assigned a key role in the design stage for a shelter they are hardly ever involved in determining the features of the shelter that are most relevant in terms of maintenance objectives. In the same way, conservators are often limited to observing and identifying the deterioration of decorative features that should be protected by the shelter but they are rarely asked to consider how the shelter itself may have influenced or could influence the decay processes.

By establishing multidisciplinarity and collaboration in the approach to shelter design and ongoing maintenance, and ensuring that this is supported by an efficient process of documentation, the archaeological site manager is able to validate decisions that are made, and the consequent cost and management implications. Given that the site manager role is generally not one of a professional maintenance manager, this ability to establish a clear overall picture of site maintenance needs is very important in enabling the site manager to make informed and objective management decisions.

It is often the case that archaeological sites suffer from a shortage of adequate intellectual and financial resources. The decision to build a shelter is therefore frequently tied to the arrival of capital investments or one-off sources of funding, which aim to provide a 'definitive' solution to problems caused by excavating archaeological remains. In this case, frank explanation of the level of resource required for maintenance in the long term, in contrast to the actual funds and human resources available at the site, is crucial. It may become evident that the level of resources or skills desired or required to guarantee effective maintenance is simply not achievable. However, where a funding opportunity does present itself, plans can be scaled accordingly at the outset. For example, a plan for shelters requiring low or 'zero' maintenance may be developed. In cases where non-specialist staff are available these personnel can be trained to carry out the maintenance themselves. In other cases, where there are sufficient resources in place to ensure the maintenance of the shelters, a capital funding opportunity could be used instead to conserve archaeological remains.

The role of stakeholders in improving the sustainability of shelters (and archaeological remains) through maintenance and monitoring

As described above, monitoring is a key part of the maintenance process. Ideally it will be integrated with site maintenance activities and engage specialist intervention, however in reality this is not always achievable for archaeological sites. Therefore, it becomes essential to involve other stakeholders in the process. Stakeholders (namely anyone who can affect or may

be affected by the achievement of an organization's objectives) such as schools, visitors, tour guides and specialist groups can prove to be a valuable and complementary resource.

Visitors can play a role in monitoring a site and its shelters, if they are involved and their input organized and recorded in a systematic way. During certain periods they can be invited to complete questionnaires, send photographs and provide feedback on temporary shelter structures. The opening or closure of areas, the presence or absence of visitors under a shelter and opportunities for data gathering on the state of conservation of the area can be useful forms of passive monitoring. Likewise, custodial staff or tour guides can also make a contribution to the monitoring of the shelters and the archaeology being protected. For example, the local heritage authority for Pompeii and Herculaneum signed an agreement with an external organization for the provision of site wardens. As part of their role, these new wardens are required to fill in a form to indicate any evidence of decay, collapse or other problems to the site manager. The opportunity to integrate this information within the GIS documentation system for Herculaneum is being evaluated.

Maintenance might also be entrusted to a specific interest group, such as construction trade schools (on-site training for shelter maintenance and other modern structures on the site) or conservation institutions (for archaeological remains). For those sites located in remote or particularly challenging areas, the involvement of the local community may be critical in ensuring a minimum level of monitoring and, in some cases, guaranteeing their survival (Buccellati 2014) (Figure 25).

Consideration of the role of stakeholders in the sustainability of the site also reinforces the need to operate at a local level, not only in procuring locally sourced materials and technologies but also workforces and training organizations. Over the long term this investment potentially guarantees that there are appropriately skilled human resources available in the local area. The subsequent impact on the economic and social development of the area, together with growing relationships with new interest groups that emerge locally, would also be an indirect result of considerable importance.

Towards sustainability: designing long-term and low-maintenance shelters

Planning and replanning shelters: a possible 'virtuous circle'

As described above, designing a shelter that is cost-effective and low-maintenance can present a challenge to archaeological sites, which often suffer from a systematic shortage



FIGURE 25: The site of Urkesh (Syria). A system of localized shelters is used to protect the original ancient mud-brick walls. The system relies entirely on local resources and local skills, which has made it possible to maintain and monitor the protective shelters in Urkesh throughout the current war under the direct, if remote, supervision of the archaeological mission.

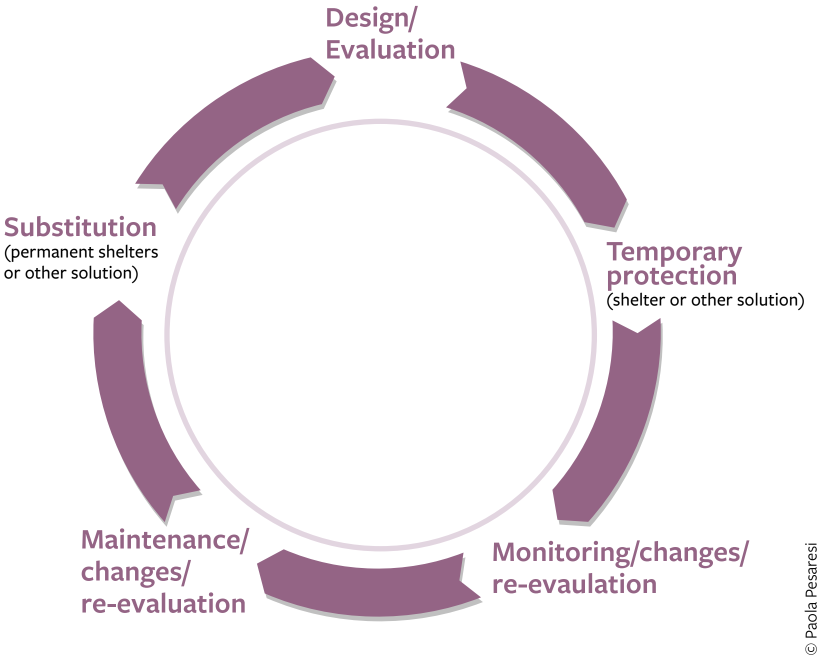


FIGURE 26: The cyclical process of sheltering: each action leads to another. The evaluation stage represents the key step to continuous improvement of the shelter in the long run.

of financial and technical resources. This is further complicated when considering the need for environmental compatibility, of complementarity with the existing historical and archaeological fabric, presentation/ interpretation needs, etc. Successful shelter design and planning that takes maintenance aspects into account requires extensive knowledge of the many factors that may affect a site over time and is not restricted to only the technical issues. As already described, it is unlikely that external consultants working in isolation will produce a successful shelter design. Multidisciplinarity is key in this type of planning, as is the active participation of the site manager and permanent site staff. Shifting the focus away from a 'one-stop' approach to designing a shelter and instead towards designing a (serviceable) lifespan of a shelter helps the site manager to recognize the characteristics that are necessary for effectiveness over time and to identify the monitoring and maintenance mechanisms most appropriate for the surrounding conditions.

The determined lifespan of the shelter will be a decisive factor in the choice of materials and techniques. It will also inform other decisions, such as maintenance techniques, additional works that might be required to ensure accessibility and monitoring practices, that may also have implications at site level. For example, the top roof layer of a flat shelter might be built separately from the rest of the waterproof structure to allow for future changes to its pitch, should another flat roof be built next to it in the future.

By considering the archaeological site shelter as a 'protection process' rather than just a 'solution to a problem' all the subsequent steps can be clearly defined. From the starting point of condition assessment followed by temporary protection (shelter or other solution), means of evaluation and monitoring and then maintenance and replacement, each individual action leads to another, eventually reinforcing the first positive action (Figure 26).

In circumstances where time or resources are too restricted to plan a long-term shelter, a temporary cover may be considered as a means of buying time in planning for a permanent solution. However, the challenges of designing a provisional shelter, including around its maintenance needs, are significant and should not be underestimated or overlooked. Indeed, temporary shelters should be considered a first step in the process of providing protection and not as a standalone solution. By adopting a long-term view from the outset, it may be possible to create a hybrid system that incorporates elements required for a more permanent structure. In reality, a well-designed provisional shelter could become a practical long-term solution, if its durability over time has been carefully planned and designed and the challenges in planning maintenance (as described above) have been addressed. The design process for a shelter on an archaeological site should be viewed as a lifecycle process that is flexible and that can respond to future changes in available resources, avoid unnecessary expenditure and make the best use of available technical skills. It should also incorporate scope to implement upgraded solutions if or when additional funding opportunities present themselves. Clearly defined systems for elements that allow disassembly and modification, without necessarily involving a complete rethinking of the structure, must also be incorporated.

The monitoring processes that are established as part of the design provide key points at which to understand where defects may exist. These will directly inform any necessary

adjustments or successive upgrades. A robust and thoughtful maintenance plan will, however, ensure continued operation of the shelter even in the event of defects occurring that cannot be swiftly resolved.

In conclusion, the design of a shelter for an archaeological site must be regarded as a *process* of long-term protection. This process must be optimized, be flexible and be iterative. Each step informs the next and enables technical and management competencies to engage and complement each other in an ever-more effective response to the challenges that face sites and site managers today.

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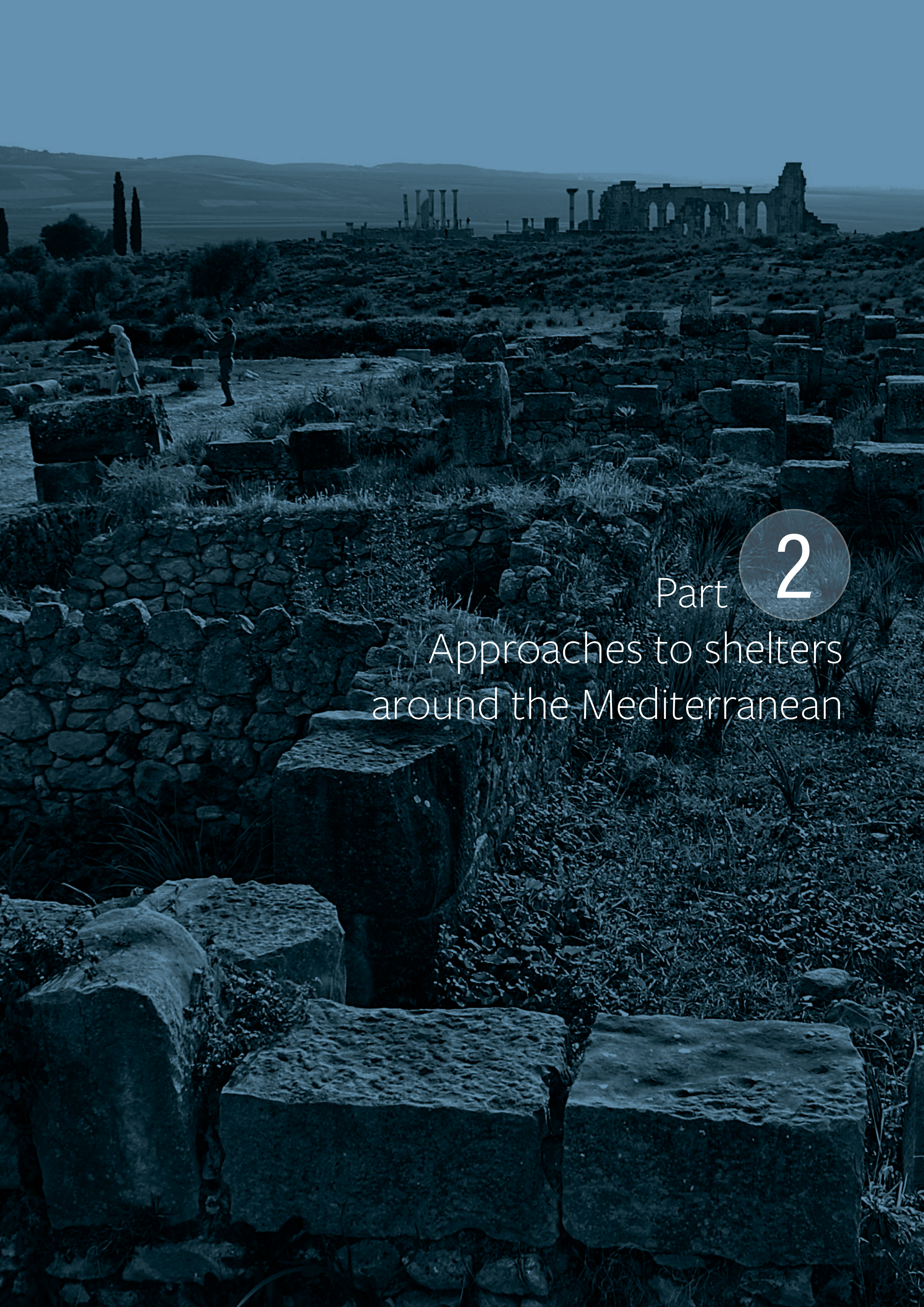
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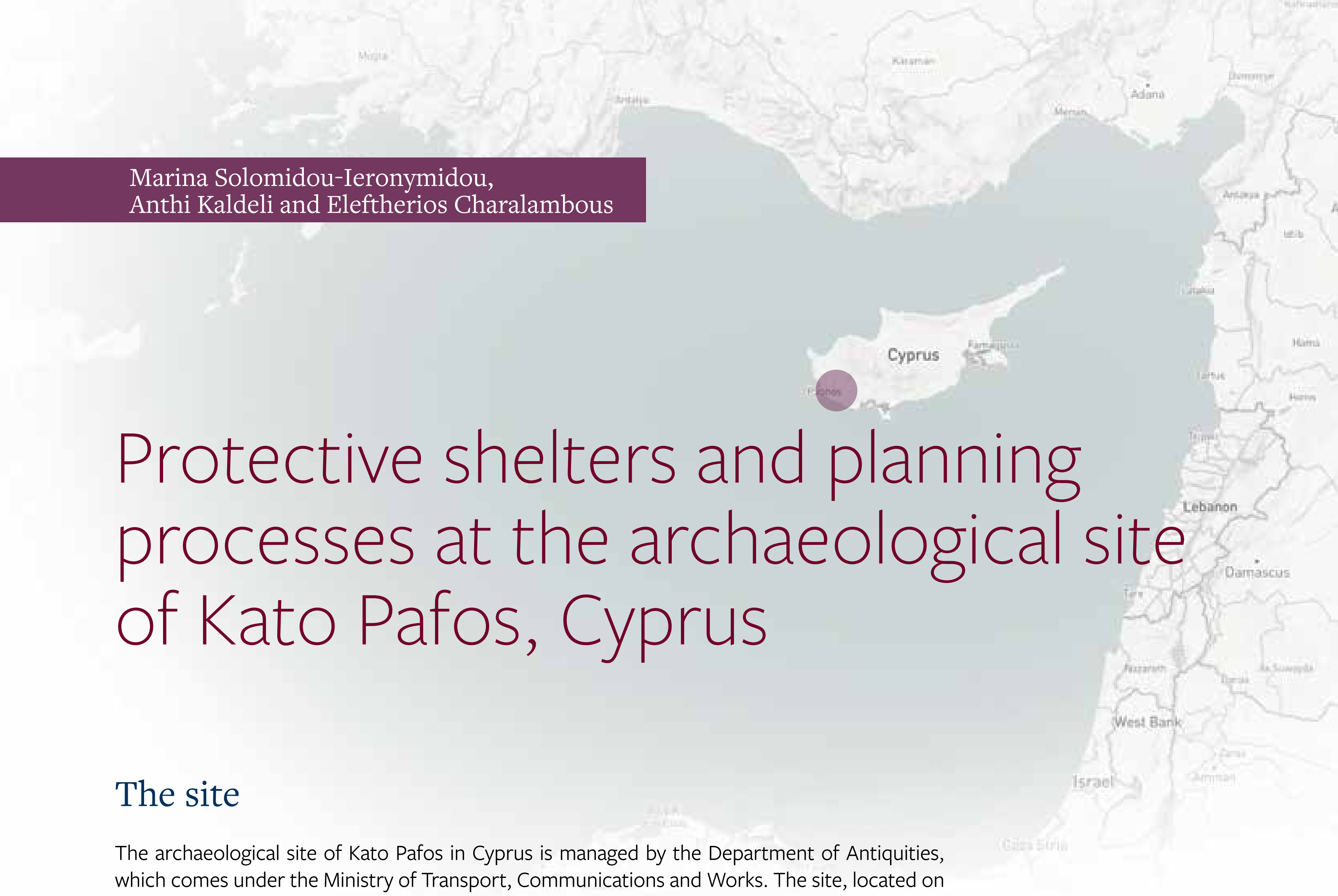
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Part 2
Approaches to shelters around the Mediterranean



Marina Solomidou-Ieronymidou,
Anthi Kaldeli and Eleftherios Charalambous

Protective shelters and planning processes at the archaeological site of Kato Pafos, Cyprus

The site

The archaeological site of Kato Pafos in Cyprus is managed by the Department of Antiquities, which comes under the Ministry of Transport, Communications and Works. The site, located on the west coast of Cyprus, dates from the Hellenistic to the medieval periods (Figure 1). Referred to in ancient times as Nea ('new') Pafos, the city was founded by the Ptolemies during the Hellenistic period (late fourth century BC), having defeated and taken over the earlier Archaic and Classical kingdom of Palaipafos ('old Pafos', which is now the modern village of Kouklia). The location of the new city was mainly chosen for its strategic geographical position, as it gave the city access to the sea and this is reflected in its sophisticated harbour. Due to its location and natural wealth, the city became the capital of Cyprus during the Hellenistic and Roman periods. As such, it comprises important archaeological remains of both periods, particularly the Roman, including administrative buildings and rich private houses decorated with mosaic floors and frescoes. The material culture from this site offers a unique insight into the ways in which imported Hellenistic and Roman traits were transferred to the island, and assimilated with local Cypriot tradition. The cultural characteristics specific to the city also reflect its key strategic location within the eastern Mediterranean, which ensured that it played a vital role in the political and economic development of both the kingdom of the Ptolemies and then of the Roman Empire.

FIGURE 1: Aerial view of the archaeological site of Kato Pafos.



Together with Palaipafos, Kato Pafos became Cyprus' first UNESCO World Heritage property. It was inscribed in 1980 on the basis of criteria (iii) and (iv). Systematic archaeological investigations led by the Department of Antiquities began in 1962 and local and foreign archaeological missions continue to excavate today. The site of Pafos is a major archaeological attraction in Cyprus and one of the most visited places on the island. Local residents also have an attachment to the site, both due to its importance in illustrating the island's past and because it provides opportunities to attract tourism to the city. This perspective is held by the municipality of Pafos in particular, which supports

new developments as a means of enhancing the overall development of the site to increase capacity and consequently increase visitor numbers to the city. In the context of this case study it is important to note that the various local authorities of Pafos have frequently criticized the absence of shelters at the archaeological site in the media, mainly because they consider them to be the only means of site protection. In other words, shelters have been a key subject of local discussion about the site because their use highlights government efforts to promote and protect the site in line with international practice. For this reason, the shelter project described below was presented to the public at both the preliminary stage and on completion of planning.

Existing conditions and protective measures

In recent years, the Department of Antiquities has kept up with developments related to the protection of heritage. A major part of the Department's strategy has been to adopt such approaches, including the construction of protective shelters and other measures for the conservation of mosaics, as can be seen in the development of the conservation programme at Kato Pafos, which has been underway at the site since 2011.

This conservation programme includes management, documentation and digitization, research, publication and promotion of mosaics, as well as the broader mechanisms employed for their preservation and protection. It is worth mentioning that, in general, the main conservation issues at the site are related to the mosaics, the wall paintings and the masonry structures. Environmental factors, such as humidity, can create problems as they lead to the decay of decorative features and building materials. Additional problems are caused by rising water levels (affected by the sea as the site is in a coastal location), rainwater, vegetation, and negative visitor impacts.

It is important to note that a series of formal measures has been adopted by the Department of Antiquities in order to protect the ancient remains across the island over time and to reduce the risk of potential deterioration, within the current limitations imposed by factors such as a restricted budget and the small number of staff. The first measure taken was to limit the intensity of new archaeological excavations by not granting permission to excavate. A second measure has been adopted in recent years for those mosaics that are not protected by shelters: processes have been established to rebury them either permanently or periodically during the winter season. Importantly this measure gives the Department the opportunity to control more effectively the remaining mosaics that are left exposed. The development of management plans for certain archaeological sites, including Kato Pafos, are also of great significance and these draw on the specific traits of each site, aiming to secure their preservation and promotion.

FIGURE 2: Part of the archaeological site of Kato Pafos showing the shelter of the House of Dionysos.



Example shelters

This chapter focuses on the upgrading of existing shelters that had been constructed in the past at the site of Kato Pafos in order to address problems relating to their functionality, in particular at the Houses of Dionysos and Aion, as well as the shelter built to protect the Hellenistic pebble mosaic at Fabrica Hill. The shelter at the House of Dionysos, constructed in 1977, is an enclosed wooden structure that only covers and protects part of the Roman house: principally the mosaics (Figure 2). The shelter at the House of Aion is an enclosed metal structure. Additionally, a hexashelter that had been constructed to protect the mosaics of the House of Orpheus, in association with the Getty Foundation,

has since been removed. As a result, the mosaics of this house are now reburied to ensure their preservation.

Both of the shelters that had been constructed in the past by the Department of Antiquities, i.e. the shelters at the Houses of Dionysos and Aion, were upgraded in 2012. The brief description below of the upgrading measures applied to the shelter at the House of Dionysos provides an example of the ways in which the Department focused its efforts on addressing a problematic situation resulting from the approaches used in early shelter building. Concerning the current constraints noted above, these endeavours are crucial in order to prevent destruction and to secure the preservation of the mosaics and the archaeological remains.

Overall, the conservation process at the House of Dionysos included the cleaning of both the mosaics and the shelter, the recording of the archaeological remains in the atrium and the installation of pipes for draining rainwater away from the atrium and the shelter. In addition, the synthetic panels were replaced, the internal and external surfaces of the wooden and metallic components of the shelter were painted, and the roof was sealed. All sides of the shelter were covered with wooden surfaces, while the walkways were also painted, conserved and upgraded with the placement of wooden supports to ensure safety for visitors. Information panels and posters were created for visitors while the mosaics were covered to prevent damage.

All stages of the conservation process were recorded and documented in detail. The wooden components that initially covered the interior frame of the shelter were removed throughout in order to enable the drying of these problematic areas. In addition, it is important to note that before beginning conservation works an in-depth study was carried out on the building technology, the type and characteristics of the mosaic tesserae, and the composition of the mortars and salt efflorescence. In addition, specialist evaluations of these elements were commissioned from the Institute of Inorganic Chemistry and Surfaces (CNR-ICIS, a department of the Italian National Research Council) in order to develop the conservation method. For these analyses, samples were collected from two areas of the House of Dionysos.

Apart from the conservation of the mosaics and the masonry, and the upgrading of the existing shelters, a number of important management results were achieved for Kato Pafos, including:

- improvement of existing infrastructure, such as footpaths and walkways, in order to increase access for people with disabilities;
- construction of new footpaths and provision of shade from the sun;
- an upgrade of the conservation laboratory;
- installation of protective railings;
- temporary and permanent cleaning of all areas;
- an upgrade of the drainage system;
- the installation of information panels;
- improvement of toilet facilities;
- inauguration of a permanent exhibition within the site on local bird species and local archaeology, which highlights the association of both natural and cultural heritage values;
- most importantly, the creation of a pilot project regarding access to the House of Dionysos for people with visual impairments.

In short, the management plan for this site not only focuses on the preservation of the archaeological remains but also attempts to integrate the monuments within the natural landscape and promote its cultural values to the public through increasing access and raising awareness.

It has become apparent that the problems involving the existing shelters, particularly as their construction had not been based upon a solid strategy, affect the overall management of the archaeological site. A new shelter was therefore designed, building upon the archaeological significance of the mosaics of this site and the Department's belief that it is imperative to provide a sustainable solution for their protection. The planning process began in 1994 and lasted for fifteen years. The aim was to incorporate under this shelter a total of 42 mosaic



FIGURE 3: Part of the archaeological site of Kato Pafos where long-term plans for a new protective shelter are now pending.

floors from the Houses of Theseus and Aion and part of the House of Orpheus (Figure 3). Throughout the process it must be noted that the Department of Antiquities and the research team faced – and tried to resolve – a series of emerging practical issues which were not under consideration at the initial planning stage. Such problems included, for example, the foundations of the shelter, and the problems that resulted from ongoing archaeological excavations, due to the discovery of archaeological remains, which necessitated changes to the position of the foundations.

The design of the new shelter at the archaeological site of Kato Pafos was largely based on the experience acquired in constructing protective shelters at the archaeological site of Kourion and the subsequent criticism they attracted, as well as increasing knowledge and the specific features of Kato Pafos. The features to be considered included:

- the climate of the region and the unpredictability and strength of local weather conditions;
- the pathology of the archaeological materials;
- the danger of collapse due to the geomorphology of the area and the stratigraphy, which could render the soil unstable, increasing the possibility of landslides occurring;
- the need to ensure visitor safety;
- the correct interpretation/presentation of the monuments and their specific features.

In addition, a series of prerequisites also had to be taken into account, such as:

- the architectural impact of the shelter within the broader character of the site;
- the need to respect the area surrounding the monument;
- a study of the building's stability;
- climate study regarding environmental conditions within and without the shelter;
- functionality;
- conservation of the building materials of the shelter and the cost for future maintenance;
- rainwater management.

The lengthy design process (1994–2009) of this *magnum opus* took place under the aegis of the Department of Antiquities. However, discussion about how it would be conducted had begun much earlier. In line with legal procedures required for construction projects, and following a tender process, advisory and research responsibilities for the project were awarded to a private architectural practice, Polytia Armos.

The terms of reference written in order to develop the shelter over the three houses and their mosaic floors formed the framework for the planning of this project in 1994. As noted above, during the planning process the Department of Antiquities and the research team had to address a number of additional practical issues that only emerged over time and could not have been predicted in advance. Along with issues related to the architectural design and the placement of the shelter, significant problems arose concerning its foundations. Further problems involved structural stability and the changes that could emerge over time due to the onsgoing archaeological excavations and the discovery of additional archaeological remains. The design phase of the project lasted for fifteen years and went through five important stages:

1994: contract signed with Polytia Armos for the feasibility study and construction of a protective shelter

This contract described a shelter made of a timber frame supported on metal supports. A framework describing the basic issues that were to be taken into account was also developed at this stage.

2002: contract signed for the study and supervision of the construction of the shelter

This contract involved the creation and supervision of the above-mentioned timber-frame shelter. It should be highlighted that the initial study on the foundations of the shelters proposed large spans so as not to obstruct the uninterrupted view of the site and the monuments by the visitors. Large foundations were foreseen with metal supports and timber frame on top. It is worth mentioning that the approach to the foundations was modified at this stage, in response to the problems encountered with the foundations of the shelter at Kourion and the criticism this had generated. This demonstrates the Department of Antiquities' efforts to learn from the Kourion experience and use it to improve management planning at Kato Pafos.

2002: contract signed for an interim study

The purpose of this parallel study was to change the design from a timber frame to a metal one, using metal supports and developing alternative methods for the footing. As a result of this study, a revised proposal for the new shelter's foundations was prepared; archaeological research then began at each location where foundations were being proposed to check their suitability. This research was completed in September 2003 and the results were rather discouraging as only 27 out of the 62 proposed points for foundations could be used as such: areas that had previously been thought free of any archaeological remains were in fact not suitable for the placing of the shelter foundations.

2004: contract signed for a further interim study

The aim of this research phase was to reconsider the type of footings required for the foundations as well as to evaluate the use of surface footings, i.e. ones that would not go down to bedrock in the light of the challenges posed by the stratigraphy and geomorphology of the area. The timber frame and metal columns were also incorporated into this new study. In particular, the study proposed a shelter made up of metal frames attached to form a square, resting on top of another metal frame positioned over a rectangular frame. In addition, the complexity of the stratigraphy underlying the foundations, and the need for precise markings, required the use of photogrammetry; a process which entailed aerial photography being carried out of the site and topographic image processing. With this new knowledge the foundation strategy was modified further with a plan to install a larger number of smaller foundations (143 instead of 62), allowing greater flexibility for identifying and using spaces for foundations unoccupied by archaeology. The new foundation points were located topographically, the areas were recorded in detail and new research excavations were initiated. However, despite the reduction in the amount of space needed for each foundation, excavation continued to reveal the ongoing difficulty of identifying suitable placements.

2007: a new pilot study

With this pilot phase the design of the project was finalized and put forward for approval and implementation. New features included a metal frame and densely clustered metal supports resting on the ground surface, together with supports for walkways. This meant that rather

than placing numerous foundation points within a 2-m^2 excavated area, smaller surface footings of 80 cm^2 were integrated into the design to support both the walkways and the frame of the roof. The study was finalized, with the main features being the metal frame for the roof placed on numerous small columns and ready-made foundations at the base of the footbridges.

Despite these improvements to the design, the installation of the shelter is pending due to financial constraints caused by the ongoing economic crisis. Indeed the Department of Antiquities has decided to reconsider the design, as well as certain parameters that affect its implementation. This is due to a number of factors: the changing economic situation and subsequent budget constraints; developments in shelter construction and expertise that have occurred during the planning process; and overall developments at the site in terms of infrastructure and ongoing excavations. Ultimately, it is imperative that the shelter, in addition to providing protection, ensures the integrity of the site and does not interfere with the understanding of the overall architectural remains, nor with the natural landscape. It is also vital to ensure efficient drainage of water away from the structures and mosaics that will be covered and to consider the maintenance of the shelter itself.

For these reasons, discussion is now focusing on the changes required to adapt the design to meet current needs and a changing situation. In the meantime, the Department of Antiquities has decided to backfill the foundation trenches that were excavated on-site in order to avoid drainage problems and to protect the archaeology. Nevertheless, the process of designing the shelter has proved a useful exercise as it has enabled Department staff to evaluate the conditions that currently exist on-site, to prioritize conservation objectives and to rethink the overall framework that will promote the site's authenticity together with the current conservation and management strategies.

The management context

Legal framework or mandate

The legal framework is to be found in Cyprus' national constitution for the Protection of Ancient Monuments, as written in the Antiquities Law, Chapter 31, dating to 1935. Additional protection was provided by inscribing the site on UNESCO's World Heritage List in 1980 and including it within the NATURA 2000 network of nature protection areas. The measures therefore taken by the Department of Antiquities for the protection of the site are also in line with the criteria imposed by the above frameworks.

Institutional framework

The primary institutional framework is the Ministry of Communications and Works of the Republic of Cyprus: specifically its Department of Antiquities, which is responsible for the protection of Cyprus' heritage and for managing its archaeological sites.

Resources

The estimated budget for the shelter described above is €7 million. This amount of money is nevertheless currently unavailable by the Ministry of Finance due to the economic crisis.

Around twenty people work at the site, including site staff, conservators and other technical officers. However, this number varies as workers are occasionally employed with temporary contracts.

Heritage processes

Planning is carried out internally by the Department of Antiquities, under the umbrella of the Ministry of Communications and Works, and occasionally in collaboration with the private sector. Certain aspects are also occasionally carried out in collaboration with the Department of Public Works within the same ministry. There is no defined timeframe for planning, as this depends on: problems that may arise and the necessary alterations or additions that need to be employed and achieved (e.g. changes to footpaths according to changes in the floor levels

or visitation, changes to facilitate access for people with disabilities, including those with visual impairments, etc.); the results of ongoing archaeological research; and the overall budget. The results are also delivered internally as all work, including the work conducted by private agencies, is managed and controlled by the Department of Antiquities, in accordance with the Antiquities Law.

The Department of Antiquities carries out and implements the actions required to address various site management objectives, according to the strategies followed by the Ancient Monuments Division. For example, with regards to the conservation of mosaics, decay conditions are fully documented through drawings and detailed reports, with this information entered into a database, while a series of other measures are applied to ensure conservation and protection based on scientific methods and techniques. Again the Department of Antiquities builds its management framework based on the problems that need to be resolved on a short-, mid- and long-term basis. In addition, despite the completion of the site plan for Kato Pafos, further changes are being carried out related to the various requirements for protection and development.

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Yael Alef

Do shelters really protect the mosaics at Caesarea, Israel?

The site

Caesarea is an Israeli National Park situated on the Mediterranean coast and it includes the ancient remains of the coastal city of Caesarea Maritima. The city, along with its harbour, was built under Herod the Great between c. 22–10 BC and it became the capital of the Roman provinces of Judaea and the later Syria Palaestina, and afterwards was capital of the Byzantine province of Palaestina Prima. Caesarea was a major port in the Mediterranean with an orthogonal street network, a temple, a royal palace, theatre, amphitheatre, hippodrome, aqueducts, bathhouse, markets and residential quarters. During the Byzantine period it flourished and extended over 400 acres; by the end of the sixth century AD perimeter walls were built making Caesarea the largest fortified city in the country. However, it was largely abandoned after the Muslim conquest of 640 and had to be refortified by the Crusaders. After 1884 it was settled as a fishing village by Bosnian immigrants. Extensive excavations took place first between 1959–1964 and then 1992–2002 as part of Caesarea's development into a national park.

Existing conditions and protective measures

A study conducted by the Israel Antiquities Authority, the Getty Conservation Institute and English Heritage to evaluate the protection afforded by shelters for mosaics found that misgivings often arise regarding the degree of their effectiveness in terms of protection and preservation (Stewart, Neguer and Demas 2006; Neguer and Alef 2008; Neguer and Alef 2009; Stewart 2008). The variety of shelters erected at Caesarea National Park over the years has turned the site into an interesting test case due to the conditions created beneath the shelters in a marine environment and their effect on the deterioration processes of the mosaics. Recognition of these conditions eventually led to three of the four shelters that had been built at great effort and expense to be dismantled.

The discovery of mosaics at archaeological sites, and the demand to turn these sites into open-air museums, poses complex problems regarding the conservation and presentation of the mosaics. In the past it was customary to remove the mosaic and exhibit it in a museum; today, however, preference is given to understanding the mosaic and presenting it at the archaeological site in context. The concept of experiencing the artistic creation in its original

location as part of the place's architecture and history was developed by Cesare Brandi in the 1940s, thus laying the foundations of modern conservation theory (Brandi 2005). This concept promoted the development of new methods of conservation for mosaics and their presentation *in situ*. Until the 1990s it was customary to lift the mosaic, cast a new reinforced concrete backing for it and return it to the site. Today, in light of our experience and increased awareness of preserving the original materials, there is greater use of traditional techniques and compatible materials such as lime-based mortar.

The assumption that a shelter is a means of protecting the mosaic *in situ* and providing it with good preventive conservation, while at the same time facilitating its presentation, led to the construction of four shelters above nineteen mosaics at Caesarea, covering a total area of 810 m^2 (Alef 2002). However, building a shelter at an archaeological site is not a simple solution: on the contrary, the construction cost is expensive and its modern presence is intrusive in the archaeological site's landscape. Moreover, the shelter often does not meet the expectations that prompted its construction. A study carried out in 2006 found that more than 30 per cent of the mosaics under shelters in Israel suffer from advanced destruction and active deterioration processes, and some of them have been permanently lost (Neguer and Alef 2008). In some instances, such as Caesarea, which was built on the Mediterranean coast,[1] the shelter itself creates microclimatic conditions that cause the accelerated deterioration of the mosaics beneath it, as compared to adjacent mosaics situated in the open. Thus the problem of the shelter highlights the complexity of modern interventions at archaeological sites, complexity that stems from different interests that sometimes conflict with the conservation, presentation and management considerations of a site. This complexity is a challenge for those engaged in conserving archaeological heritage.

Example shelters

The shelters above the *domus* and bathhouse

The Roman *domus* (house) and Byzantine bathhouse were built in the first and fourth centuries respectively, and were in use for more than 200 years. The interiors of these structures were adorned with marble fountains and paved with mosaics. They were excavated by J. Porath between 1992–1996 on behalf of the Israel Antiquities Authority (Porath 1996). In 1995 a temporary wooden shelter was erected in order to protect the remains during conservation and development work. The mosaics were stabilized with lime-based mortar and their maintenance includes monthly wet and dry cleaning. In 2001 the temporary shelter was replaced by two permanent shelters designed by the architects A. Kedar and D. Abu-Hazira, one above the bathhouse and the other over the *domus*. The decision to cover the mosaics in these two structures was taken mainly because they were located in deep excavation pits where the rainwater could not be easily drained. Their construction cost was approximately US$ 191,000 (Figure 1). These two steel structures supported a roof covered with metal sheeting and a ceiling made of aluminium panels. Gutters and drainage pipes were installed along the structure's perimeter. An area of 646 m^2 was covered at the bathhouse by a shelter that was 5–6.5 m high; that above the *domus* covered an area of 390 m^2 and was 3–5 m high.

Comparison between the mosaics left exposed outside since their excavation in the 1990s and those that were covered showed that the condition of the exposed mosaics was better than that of the mosaics beneath the shelters. This phenomenon can be explained by the high relative humidity and moisture content with dust and salt in the marine environment. The dust and salt together with the high humidity create an acidic-like aerosol that causes an aggressive deterioration process. While the shelter does provide horizontal protection from the rain, it does not prevent the aerosol and dust from accumulating on the mosaics. The dust and salt that settle on the exposed mosaics is washed away by the rain, whereas their removal from the mosaics under the shelter is dependent upon proactive maintenance measures. This meant that a shelter designed to provide shade for visitors and protect the

[1] The climate is characterized by high humidity, an average annual precipitation of 600 mm and high salinity: see Bitan and Rubin (2000).



FIGURE 1: In 2001 two large shelters were constructed above the *domus* and bathhouse in Caesarea. The shelter, situated in a marine environment, protects the mosaics from rain but allows aerosol and dust to accumulate on the mosaic.





FIGURE 2: Aluminum panels detached from the ceiling of the protective shelter during the winter storms.

remains from rainwater actually created a new problem: the accumulation of dust and salts. This does not necessarily mean the decision to cover the mosaics was wrong; however, this situation created the need for frequent regular maintenance in order to prevent the accumulation of harmful deposits.

Another problem that arose with the construction of the shelter relates to its durability and maintenance. Winter storms that strike the region tore the aluminium panels off the shelter where they covered the *domus* and the bathhouse, placing visitors at risk and causing damaged to the archaeological remains (Figure 2). Reinstalling the panels increased the cost of the shelter's maintenance. In certain cases maintenance of the shelter was carried out without conservation supervision, resulting in damage to the mosaics where heavy ladders were placed directly onto them. Other problems regarding the structure's durability were related to the corrosion of metal parts damaged by the aggressive environmental conditions. Ultimately,







FIGURE 3: Aerial view of Caesarea after dismantling the bathhouse shelter and the Ibex Mosaic shelter when it was realized that their continual maintenance was unsustainable. Only the *domus* shelter remained out of three permanent shelters constructed on the site (above). General view of the bathhouse shelter (far left). Photo taken during the dismantling of the bathhouse shelter (left).

the cost of frequent maintenance of the mosaic, especially the shelter, led to the decision to dismantle the shelter above the bathhouse, just nine years after it was built (Figure 3).

An experimental shelter above Mosaic NN4

In a marine environment such as that found at Caesarea, the basic conditions exist for the formation of condensation beneath the shelter. Wet/dry cycles due to condensation then accelerate the rate at which stone deteriorates and metal corrodes. An extreme case of condensation was observed in the experimental shelter over Mosaic NN4 at Caesarea. The shelter was constructed above a small mosaic in 1998 as part of a study by the Getty Conservation Institute and the Israel Antiquities Authority, aimed at examining the effects of maintenance on mosaics (Piqué, Neguer and Lucherini 2003). This was a low shelter with a double-pitched roof facing north and south. It rested on a wooden structure with columns





FIGURE 4: The experimental shelter over Mosaic NN4 at Caesarea was built in 1998. Moisture content, the result of condensation, is evident on the mosaic it protects when photographed during the summer; the problem is caused by a lack of ventilation in the humid climate. This mosaic also suffers from wind-driven rain and runoff entering from the sides of the shelter and insufficient protection from direct sunlight, which accelerates the wet/dry cycle.

set in concrete cubes that served as a foundation. The mosaic was inspected in the summer months and was found to be wet (Figure 4); this was the result of a lack of ventilation that had caused condensation. Severe disintegration of the tesserae and mortar was evident. In order to identify the source of the salts causing the deterioration, newly created mosaic panels, detached from the ground, were placed beneath the shelter. This was to create a test scenario, to rule out the possibility that deterioration was a result of salts making their way up from the soil. The findings demonstrated the tesserae in the test panels quickly disintegrated into powder (Figure 5). The risk factors identified in these conditions are: high relative humidity, the presence of marine aerosol, accumulation of dust, and moisture content as a result of the condensation formed beneath the shelter. These cause daily wet/dry cycles that accelerate the crystallization of salts. This process, in different variations, is the key to understanding the typical deterioration processes of mosaics under a shelter.

The Ibex Mosaic

In the 1990s an excavation directed by J. Patrich of the University of Haifa uncovered the Ibex Mosaic, which is one of the most impressive mosaics at Caesarea, and in 1997 a temporary protective shelter was built over it. The shelter consisted of a wooden frame covered with asphalt shingles and included columns set in poured concrete that functioned as above-ground foundations (Figure 6). The shelter's lack of maintenance caused several problems, among them nesting birds and an accumulation of droppings on the mosaic, and dripping water, including rust from metal parts and irreversible staining of the mosaic, all of which contributed to the mosaic's overall dismal appearance (Figure 7). The shelter covering the mosaic collapsed in a winter storm in 2012 and has not been rebuilt.

Conclusions of the study

The findings of the study of the shelters at Caesarea revealed the complex dynamics of this type of intervention at an archaeological site. Whereas the shelter protects against the rain, it can





FIGURE 5: The experimental panel (left) shows the severe disintegration of the tesserae caused by the aggressive environmental conditions beneath the experimental shelter over Mosaic NN4, namely relatively high humidity, condensation and accumulation of dust and aerosol on the surface of the mosaic. These phenomena are also evident in the disintegration of the mortar (above).



FIGURE 6: The shelter above the Ibex Mosaic.

create new unforeseen problems, such as salt and dust accumulation, and cause accelerated deterioration due to higher humidity levels. This chapter illustrates the function of the shelter as an ecological system of interrelationships between environmental variables: rain, wet/dry cycles, aerosol, salts and dust accumulation.

The study's conclusions have shown that aerosol at Caesarea is a major risk factor for the mosaics; more so than rain, which is generally considered the main risk factor in other environments. Conversely, in a marine environment the rain washes the mosaic, thereby reducing the harmful effect of the dust and salt that accumulate on the mosaic surfaces. Consequently, at Caesarea today more frequent maintenance is required of the mosaics under shelters than those exposed to rainwater. This shows the type of data that should be considered



FIGURE 7: Rust stains on the Ibex Mosaic caused by the protective shelter.

when planning the conservation, maintenance and management of an archaeological site like Caesarea, which should include information on the accumulation of salts and dust, rain and wet/dry cycles.

The management context

Legal framework or mandate

The legal framework consists of several components:

- The site has been declared an Antiquities Area by the Israel Antiquities Authority under the Antiquities Law.
- The site has been declared a National Park under the National Nature Reserves and National Parks Law, prescribing protective regulations and giving authority to the National Parks Authority (which comes under the Ministry of Environmental Protection) for its protection, development, management and control.
- A local master plan under the Planning and Building Law regulates the planning and land use on the site.
- Caesarea is on the Israeli tentative list for UNESCO World Heritage status.

Institutional framework

Caesarea is an exceptional case in which a national park was declared for an area that is mostly privately owned: the Caesarea Edmond Benjamin de Rothschild Corporation acts as a local authority. Therefore, the site is jointly managed by the National Parks Authority and the Caesarea Corporation, which divide responsibilities between them: the ancient port and the area of the crusader citadel, combining tourist and commercial activities, is managed by the

Caesarea Corporation, while the ruins of the Roman and Byzantine city and the theatre, which was reconstructed to host modern performances, is managed by the National Parks Authority. The Israel Antiquities Authority employs a conservation team on-site and is also an important stakeholder in decision-making regarding excavation, conservation and development.

Resources

The annual budget of the National Parks Authority is approximately €300,000 and that of the Israel Antiquities Authority is approximately €250,000; information for the Caesarea Corporation is not available. This combined budget covers regular maintenance and ongoing operations but does not include planning and development projects.

There are approximately fifteen workers who are local staff of the National Parks Authority and who are responsible for the ongoing operation of the park. The Israel Antiquities Authority has another fifteen local workers who are responsible for year-round conservation maintenance. Information about the Caesarea Corporation staff is not available. Other external consultants and contractors are identified as necessary for project.

Heritage processes

During the 1992–2002 excavations a conservation inventory of all site elements was created by the Israel Antiquities Authority conservation team in order to inform the large-scale conservation project that followed the excavation and development of the site for visitors. The conservation plans were accompanied by a cyclical maintenance plan for the entire site, including periodic monitoring and upkeep of infrastructures and archaeological remains, and this is carried out by the local conservation team. Other development plans are outsourced and carried out by contractors per project.

The vast size of the park, the combination of commercial functions and tourism, in addition to several stakeholders with conflicting interests, are a complex management challenge. The general condition of the archaeological remains is fair, however the absence of an overall management plan may at times result in prioritising commercial interests over archaeological ones.

About the author

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Paola Pesaresi and Alessandro Massari

Approaches to the shelters at Herculaneum, Italy

The site

Herculaneum archaeological site is on the Bay of Naples, in southern Italy. It is managed by the local heritage authority: the Special Superintendency for the Archaeological Heritage of Pompeii, Herculaneum and Stabiae (*Soprintendenza Speciale per i Beni Archeologici di Pompei, Ercolano e Stabia*).[1]

The Roman town of Herculaneum was destroyed by the eruption of Mount Vesuvius in AD 79, along with Pompeii and many villas in the area (Figure 1). The nature of its destruction meant that not only its structures survived on multiple floor levels but also many of the organic architectural elements, furniture and fittings were also preserved. Most of the buildings in Herculaneum were residential or small businesses, providing a particular insight into daily life in the ancient world. For some people the site is also a reminder of the risk of living next to a volcano, which is still active today, attested to by the skeletal remains of over 300 people that have been found along the ancient shoreline.

The town was rediscovered and then explored by tunnel in the eighteenth century but it was not until the twentieth-century excavation campaign, under archaeologist Amedeo Maiuri, that the archaeological area that can be visited today was largely created. Maiuri's team excavated, restored and presented the Roman town to the public, complete with *in situ* displays of finds (Camardo 2007). Today four and a half hectares (six hectares if the adjacent archaeological area of the Villa of the Papyri is included) are uncovered, although this is only about a third of the original extent of Herculaneum.

FIGURE 1 (previous page): The Roman town of Herculaneum lies at the foot of Mount Vesuvius; when the volcano erupted in AD 79 it buried the town in specific environmental conditions that preserved even organic materials.

It is possible to look out from the site across the Bay of Naples, with views across the sea to the islands of Capri and Ischia. Mount Vesuvius is also clearly visible. The modern town rises above the ancient one, with several eighteenth-century buildings along the 'Golden Mile' clearly identifiable: reminders of the interest of the Bourbon court in the discoveries at Herculaneum and the consequent popularity of the area for nobles at that time. The site can be seen by those residents who live along the immediate borders of site. In addition, the recent creation of a ticketless park area at the entrance to the site means that local residents and visitors can now enjoy views into the archaeological area without necessarily buying an entry ticket. As the

[1] Since the symposium was held in 2013 the management situation has changed, with a reform of the Ministry of Culture granting management autonomy to Herculaneum in 2016.

archaeological area is approximately 20 m below modern ground level, most of the site is viewed from above. Shelters are clearly visible and any new additions are prominent (Figure 2).

Existing conditions and protective measures

Although Herculaneum emerged extremely well preserved at the time of excavation, the archaeological site that can be seen today has been exposed to the elements for more than 60–80 years, and in some cases for over a century (*Insulae* II and III). As is often the case, the incredible wealth of rediscovered heritage is extremely fragile: this is the case, for example, of carbonized timber left *in situ*, but also of frescoes, mosaic and beaten earth floors, which are continually trodden on by visitors. Site morphology is also a factor that contributes to exacerbating the conservation challenges posed by the preserved heritage: the street level of the ancient city is located approximately 10–20 m below that of the modern city, which itself was built on a ridge formed from successive eruptions of Vesuvius. This means both difficulty in ensuring that the excavated escarpments are structurally sound and maintained, as well as difficulties in draining rainwater and groundwater that accumulates within the site.

Amedeo Maiuri, during his ambitious excavation and restoration campaign between the 1920s and the 1960s, aimed to reconstruct shelters over the most highly decorated rooms where archaeological evidence supported it (Figure 3). He employed other means of protection (for example, layers of sand) where there was insufficient evidence. In most cases, Maiuri reconstructed the floor slab of the upper floor as a shelter, although it was not originally intended as such, and installed water drainage systems for them. Where possible, he directly reconstructed a portion or an entire roof *ad identicum* i.e. in a similar manner to what had

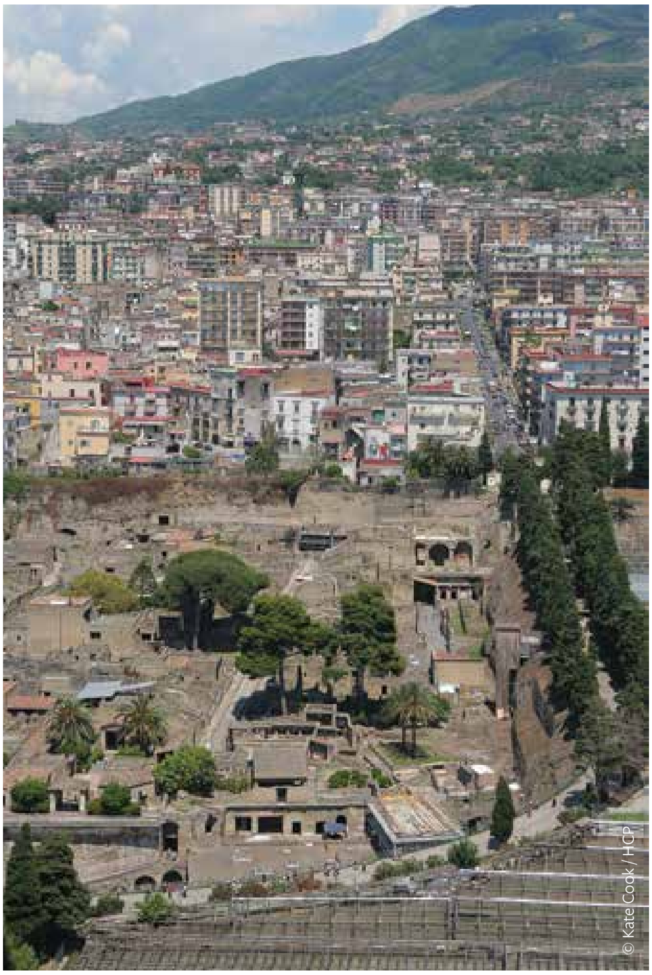


FIGURE 2: The archaeological site lies 20 m below the current ground level and the modern town of Ercolano was built over it from the medieval period onwards. The ability to view the site from above on all sides is a factor that needs to be taken into consideration when designing protective shelters.

FIGURE 3: Most of the archaeological site of Herculaneum was excavated in the first half of the twentieth century, when teams dug down through the volcanic material to expose the Roman buildings, often finding the original roof structures *in situ*, although not structurally sound.



been found during excavation (as in the case of an impluviate roof over an atrium). By doing so he managed to emphasize the urban nature of the archaeological site, while also improving the aesthetic of the structures and the understanding of them. These upper-floor roof slabs, however, being naturally flat, did not provide an efficient water drainage system and, despite careful installation, required constant maintenance because of the accumulation of leaves and debris blocking the gutters. More generally, the modern integrations using technologies and materials believed at the time of excavation to be 'infallible', proved to require much greater maintenance than the original structures. With organizational changes within the heritage authority and the consequent gradual failure of the maintenance system set up by Maiuri, these shelters have quickly deteriorated and in many cases have collapsed, damaging the valuable decorative features below or leaving them exposed to the elements.

Since 2005 the Herculaneum Conservation Project (HCP) team has focused on these existing shelters, with widespread repairs, replacement and upgrading of materials, construction techniques and waterproofing and drainage systems, in order to ensure greater durability and reduce maintenance needs, even for the flat roofs (Figures 4–5). At the same time, a campaign to develop experimental roofing has sought solutions for those uncovered areas where the absence of regular maintenance and dedicated teams had compromised any possibility of implementing alternative protection (Pesaresi and Rizzi 2007). Finally, the immense task of emptying and reactivating the ancient sewer system has enabled the efficient disposal of the water collected from the new roofs. At the time of writing, HCP activity is focused on re-establishing sustainable maintenance mechanisms that are compatible with the current superintendency management system and resources available (Pesaresi 2013; D'Andrea and Pesaresi 2014). This activity is supported in parallel by research and visitor studies, which, it is hoped, will help provide a frame of reference both in terms of new protective shelters as well as in identifying effective alternative means of reducing the decay and improving appreciation of the site.

Example shelters

There are a number of shelter typologies at Herculaneum:

- Flat roofs (floor slabs on upper levels reused as roofs): these are the most common type of shelter and those that require the most maintenance; for years the HCP team has been working to improve their effectiveness / durability, as well as working on their water drainage systems (Figure 6).



FIGURE 4: A site-wide conservation campaign saw repairs take place on modern shelters throughout Herculaneum. Where the original Roman structure does not survive up to its roof height the original floor slab of an upper floor in the building has often been used as the basis of a new covering.



FIGURE 5: When Herculaneum was excavated in the twentieth century some roofs were reconstructed by archaeologists in their original form. These now require periodic maintenance to ensure that they continue their protective function.

- Tiled roofs (always restored *ad identicum*): these are not particularly efficient from the point of view of water drainage (especially those that drain water into an atrium within a building) and are often difficult to reach or to maintain. HCP is developing systems to improve efficiency and durability and access routes to facilitate their maintenance.
- Transparent or semi-transparent roofs: these are fairly rare but a useful way of giving the impression of original open rooms or areas that now require a protective shelter (Figure 6). They are difficult to access, are not long-lasting (the materials in particular are not very durable) and create problems when controlling micro-environmental parameters; HCP is experimenting in this area (for example, in the House of Neptune and Amphitrite) and is monitoring the environmental conditions, so as to be able to suggest more suitable solutions in the future.
- Temporary roofs in multilayered corrugated iron sheets: these are found as 'temporary' shelters put in place where there were no immediately obvious long-term solutions (Figure 6). This is the case, for example, in areas with low perimeter walls, which would require substantial reconstruction to be permanently roofed, or in rooms that could be left uncovered but still require more extensive interventions for which resources are not immediately available, or even areas that still have an original shelter that is not at risk of collapse but no longer effective and further infiltration must be stopped. These shelters are intended to last for up to ten years at most and HCP is trying to adopt solutions that are compatible with safety and anti-seismic standards, as well as being adaptable to various types of environments and situations, as well as being low maintenance and low-cost. Moreover, HCP is exploring methods of integration between these structures and permanent options in order to build hybrid systems, which can be transformed over time into permanent shelters.
- Experimental temporary roofs: shelters built by HCP in 2007 in an attempt to offer alternative solutions to the temporary roofs described above: improvements in efficiency and durability (up to twenty years) and aesthetic impact (Pesaresi and Rizzi 2007). These roofs require minimal maintenance and are efficient, and are low cost in terms of construction and care.







FIGURE 6: Different shelter typologies employed at Herculaneum on a case-by-case basis: a) transparent roofs (left); b) temporary roofs in multi-layered corrugated iron sheets (centre); c) floor slabs on upper levels reused as roofs (right).

The vast majority of permanent shelters created by HCP since 2005 are in the flat roof category. These roofs, by their very nature, have a difficult task as they drain rainwater slowly due to the shallowness of the pitch. This shallow incline means there is a need for constant and careful maintenance, to eliminate problems caused by the build-up of debris and foliage. In addition, the roofs that today act as protective shelters originally functioned as upper floors within the building and, therefore, were built without requiring any consideration of protecting the rooms below or of the durability of the shelter itself or its wooden elements (beams, planks, etc.). In recent years HCP has sought to develop, test and continually improve waterproof layers that improve protection of timber elements while also respecting the way Maiuri indicated the ancient floor level. Improvements in materials and implementation have also been fine-tuned. Interventions on the roofs have always been preceded by a thorough diagnostic analysis (humidity and overall condition of the structures and the decorative features), and integrated with work to fix existing water drainage systems or create news ones. Finally, a package of works is underway to improve accessibility for maintenance works, so to maximize the resilience of interventions that have been completed or are in progress.

Currently, as well as continuing to implement *ad identicum* shelters to replace existing ones that are no longer functional, and building on HCP's achievements in recent years, plans are now in place to design new temporary shelters that are low-cost, safe and are aesthetically acceptable. These 'temporary' shelters will be created in such a way that they can be adapted to a range of spaces.

The management context

Legal framework

National heritage legislation is based on a reference in the 1948 Italian Constitution and has been the subject of legal reforms to the present day. Current legislation (42/2004 Codice Urbani) foresees safeguarding as the domain of the public authorities (Articles 3–4) and envisages participation by the private sector only for enhancement (Article 6). However, even with recent reforms, this extensive heritage legislation outlines a conventional (materials-based) approach to conservation. Importance is not given to heritage values and there is no mandate to work with other stakeholders. This often means the heritage cause suffers from

a lack of broader community engagement or additional funding sources. In addition, legislation fails to evolve in a way that facilitates the practice of the cultural heritage protection and enhancement because the system is heavily top-down, unreceptive to change and information does not go up the ladder.

Herculaneum is part of the World Heritage serial site including Pompeii and Torre Annunziata and therefore its management must be carried out with regard to World Heritage obligations.

Institutional framework

The central public authority responsible for cultural heritage is the Ministry of Cultural Heritage and Tourism. Each region of Italy (a total of twenty) has a ministry office, a regional directorate which acts as the interface between the ministry and the local heritage authorities known as superintendencies. It is the nationwide system of local superintendencies that directly manage the heritage within a close and inflexible relationship with the central ministry on which they entirely depend for management of all employees (who are directly employed and paid by the ministry) and for all annual funding for activities (safeguarding measures and others).

An exception to this very centralized management system is the 1997 initiative creating a small number of autonomous superintendencies. These are the few local heritage authorities with a special mandate that grants them administrative and financial autonomy from the ministry regarding all activities (but not staffing), allowing them to keep and manage income from ticket sales and other sources of revenue. This is the case of several major museums and two major archaeological superintendencies, those of Rome and of Pompeii; the latter is responsible for all Vesuvian archaeology (public-owned and public-run sites and museums) and is the heritage authority responsible for this case study.

Two agreements – a 2001 Memorandum of Understanding and a 2004 Sponsorship Contract[2] – created a multilateral collaboration known as the Herculaneum Conservation Project (HCP). It effectively constitutes a temporary public-private management system, which exists as a response to the permanent public heritage management system i.e. a micro-management system created to respond to shortcomings in the macro system.

Initially, a conventional agenda was adopted ('saving Herculaneum from ruin') thanks to the input of specialists. By 2006, in part thanks to input from the project team and other stakeholders, project aims shifted to also place emphasis not just on protection but also on: enhancement, access, use and values; greater consultation, partnership and participation; a more inclusive approach to planning and review; and establishing approaches which are sustainable and reapplicable by the public authority management system in the future when HCP has closed (in Herculaneum but also in its other sites; Thompson 2007). This led to a formal redefinition of project objectives (Camardo, Court and Thompson 2012).

HCP is not a legal entity and it exists as a multilateral collaboration between three primary partners: one partner is the Packard Humanities Institute, founder and the main 'owner' of the project and the principal source of funding; one partner is the local public heritage authority responsible for running the site; the third partner is the Italian-based UK research institute, the British School at Rome, which was brought on board three years after project launch to reinforce the impact of HCP, particularly in operational terms on-site with major campaigns of archaeological conservation. The British School at Rome is the operative arm which directly appoints the freelance consultants and works contractors; they work in unison with officials from the superintendency to form the HCP project team.[3]

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2 The former between an American philanthropic foundation, the Packard Humanities Institute, and the local heritage authority. The latter was based on new heritage legislation and was between an Italian-based UK research institute, the British School at Rome, and the local heritage authority.

3 This changed in 2013 when the Packard Humanities Institute launched its Italian branch, the Istituto Packard per i Beni Culturali, which then replaced the British School at Rome as the operative partner of HCP. In addition, Herculaneum gained management autonomy from the superintendency for the Vesuvian sites in 2016. The new management authority is known as the Parco Archeologico di Ercolano. For more information see: www.herculaneum.org

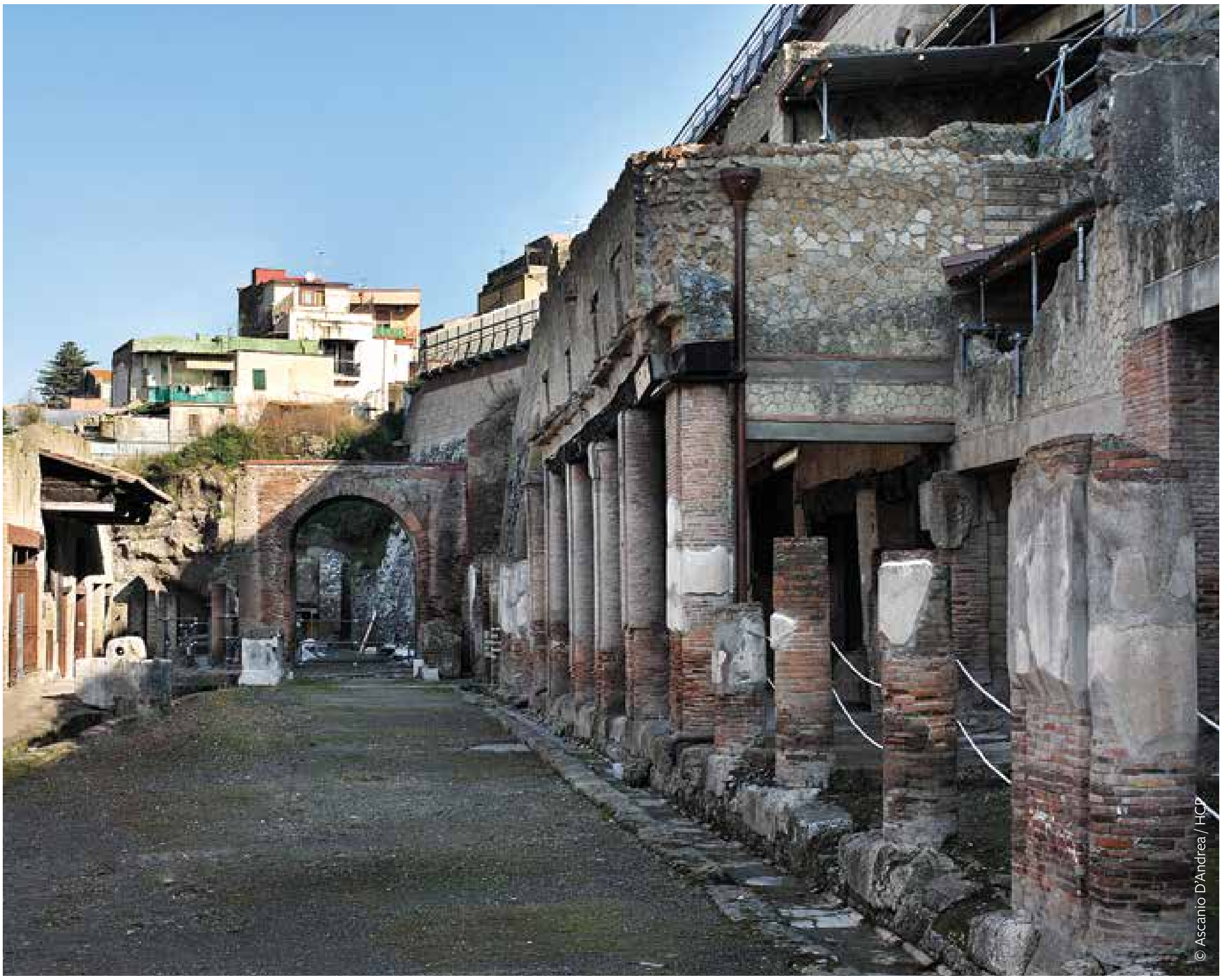


FIGURE 7: The main street of the Roman town – the Decumanus Maximus – was blocked by barriers at the beginning of the twentieth century as unmaintained upper floors and modern shelters crumbled. An emergency campaign resolved these issues and the street was reopened to the public; now other projects are addressing longer-term issues in the buildings.

The HCP project team effectively constitutes the day-to-day organizational framework, which deploys and manipulates resources, carries out planning, implementation and monitoring etc. A Scientific Committee meets annually to oversee the coordination between the partners, review and approve strategies proposed by the project team and review wider project objectives. In order to reinforce (not weigh down) the superintendency, a light organization was created with a modest management structure and (where possible) light administrative procedures.

Resources

Financial: Less than 0.3 per cent of Italian public funding goes on cultural heritage and the resources situation was critical until autonomy was granted in 1997 (this was seen at Herculaneum in the number of Roman houses closed to the public and Roman roads filled with barriers during the 1990s, and the site being included in the *ICOMOS World Report 2001/2002 on Monuments and Sites in Danger* (Figure 7)). Ordinary rolling funding now comes from ticket income and periodic capital funding comes from regional or central government (usually European regional funds) but often with excessive emphasis on one-off projects with major public visibility and not on improving the sustainability of site management.

Within the context of HCP there are also philanthropic grants from the Packard Humanities Institute. Initially these were sporadic grants but in recent years they have become annual, providing greater security. However, the timeframe is still insufficient for truly effective long-term planning. The current project phase foresees a period of handover when the super-

intendency and the private partners pool their resources in a joint programming exercise to favour long-term sustainability of approaches introduced.

Human: There is a large body of in-house staff within the superintendency but under five per cent of them are technical staff who are responsible for the whole Vesuvian area (in 2009 just 46 of them were archaeologists, architects or conservators out of a total of 1,038 staff members) and there is a shortage of legal/administrative expertise for good outsourcing. There is no possibility of tuning staffing to needs since staffing is managed centrally by the ministry and is inflexible. The superintendent and site directors are usually academic archaeological experts rather than management specialists and the management system tends to put emphasis on the academic importance of the sites, over their status as the collective property of humankind. The management system hosts the required intellectual know-how for planning and implementation of routine site care but access to good quality specialist expertise (for more ambitious conservation, management and enhancement programmes) is not always possible. Training happens but not always in the most pressing areas (e.g. organizational aspects) and technical staff roles are over-diluted allowing them little time for self-improvement. Partnership with external organizations, public or private, to build capacity in weak areas is not easy to achieve.

For Herculaneum, the superintendency outsources nearly all works and some consultancy activities for preparing proposals and supervising specialist works (the latter only when it can be demonstrated that the in-house technical staff cannot carry it out). The increase in activities which are outsourced has not been matched by an equivalent investment in improving approaches to outsourcing. This has led to reduced continuity in the care of the sites and grave consequences for their state of conservation.

A key feature of the support offered, thanks to the creation of HCP as a partnership, is the year-round involvement of a team of local and national freelance specialists (continuity is sought in the core team of consultants) who work alongside the permanent public superintendency officials. This HCP project team is supported by:

- Partners for research and training and local capacity building. Local, national and international partners are recruited to reinforce research and training and identify new forms of support for the long-term future of the site (not just financial).
- Know-how is increasingly sought within the local community thanks to participatory initiatives (e.g. oral history projects, etc.) and the international community (e.g. solidarity from the international educational programmes, etc.). This is also achieved thanks to a sister initiative, the Herculaneum Centre (public-funded association), which was launched by HCP with the municipality and the superintendency in 2006 with longer-term aims.
- Works contractors (usually selected by competitive tender simulating public works law) for implementation stages.

Self- and peer-evaluation mechanisms and incentives are promoted within the project team but progress can still be made in this area.

Heritage processes

The main planning tool used by the superintendency is the Triennial Conservation Programme together with the more detailed Annual Programme. Proposals by technical staff are gathered and reviewed by a committee against the resources available. This is more effective than it was before 1997 because at least funding possibilities are now more secure (previously central funds were allocated unpredictably, in small amounts and late, hindering systematic effective planning). However, the planning documents remain shopping lists of specific isolated interventions which do not track the interdependent nature of initiatives at various scales (improving site infrastructure to reduce running costs, rolling maintenance campaigns, specific conservation projects, trials to improve quality and cost effectiveness of conservation methodology, visitor management, etc.). Consultation is limited to in-house technical staff and only in the early stages of the process; thereafter purely administrative evaluations compromise the contribution of the technical staff.

Within HCP, planning is generally annual but there is a degree of flexibility and all three main project partners welcome mid-programme changes that are a result of learning from experience (this somewhat compensates for the difficulty of genuine long-term planning). Similarly, special projects can follow their own unique management route according to need. Substantial resources are dedicated to the planning stage, including: detailed estimating (in terms of scope, cost, time and quality of the outputs and outcomes); extensive input from those working most closely with the cultural property; and fairly broad consultation (but still not broad enough, with still insufficient involvement of superintendency colleagues and limited participation of other stakeholders). New projects for the edges of the site are testing a more integrated approach to involve the local community in all stages. Programming is generally based on the site's needs and on shared objectives.

Large works packages are often preferred to limit additional administrative procedures in an overly bureaucratic system (even if this produces increased technical and quality control problems). The limited attention given to estimating the resources and timetable required by the initiatives proposed means the Annual Programme often does not correspond to the actual organizational capacity of the superintendency. As a result, many of the initiatives are either not implemented by the superintendency in the year they were forecast to take place or never happen. When initiatives do take place, a lack of detailed advanced planning/estimating and limited administrative/legal expertise means costs and timetable escalate thereby leading to:

- works campaigns closing incomplete (costs overrun with contractual inflexibility for extras);
- externally-funded initiatives risking overrunning with the consequential loss of the Regional Council reimbursement (in the case of European funding);
- insufficient works supervision (because in-house technical staff have to meet many demands and are overloaded) in turn leading to bad outsourcing and poor quality workmanship.

Implementation is often also hindered by the complex legal implications of disputes and by the torturous administrative steps that each external contract has to go through before being activated (anti-mafia procedures slow everything down), signed off and site areas are handed over for use. However, pragmatism and goodwill in the face of such difficulties has meant that contractors and specialists work together to promote greater mid-contract flexibility to compensate for the slow legal system, the bureaucratic hurdles and, most of all, the shortcomings of the planning stage.

Where possible, HCP actions are grouped in logical typologies or broken down into phases of manageable works packages. This ensures initiatives correspond with the organizational capacity of HCP and thus the flexibility required by archaeological conservation work can be better guaranteed.

Emergencies that occur at mid-implementation stage are expected and so resources are deployed to cover the continual replanning required. In terms of the ladder of control, a single point of responsibility is identified for the implementation of the overall Annual Programme (the project manager) but also for every action and for its entire lifecycle (not just the implementation phase as is the case for superintendency colleagues). The personal liability of these responsible individuals is limited thanks to insurance policies and a measured distribution of responsibility by the client (in contrast with colleagues in the superintendency who take extensive personal liability to implement and supervise works contracts). There is a major attempt to improve procurement routes within the limits of public law (so they are reapplicable within the superintendency context but as simple and as tested as possible) to improve the cost/benefits of contracting routine site care.

While superintendency technical staff do not carry out a formal monitoring of the sites, of the initiatives taken or of their ability to protect the Outstanding Universal Value (with respect to World Heritage Convention obligations), their continual presence and consolidated knowledge of the sites is vital to future programming. Site wardens offer an important, if informal,

contribution to site monitoring, signalling areas in need of emergency repairs, etc. Annual and Triennial Plans are published in advance but no data is divulged of actual work completed or if this corresponds to planning: this is indicative of the lack of a review mechanism to improve the results of specific initiatives and to identify necessary improvements to the management system itself. In terms of overseeing the archaeology that is found throughout the territory and not in specific public-owned and run archaeological sites, the superintendency works with other agencies (police and municipalities).

HCP carries out the systematic mapping of decay phenomena, and daily monitoring of the site and mechanisms are in place to review regularly initiatives taken by HCP (meetings, reporting and committees). There is no formal monitoring of the ability to protect the Outstanding Universal Value. There is coordination and integration of the contribution of project partners and project participants to improve monitoring and review processes and inform future actions. Lightweight but effective review procedures are favoured. Closeout reporting to principal stakeholders takes place to certify and review work completed. Trends are monitored and data captured to ensure administrative correctness and inform future programming. Substantial attention is given to communication and information management. There is also an awareness of risk management in daily practice and control, even in the absence of formal procedures.

All the same there is a continuing shortage of formal monitoring, control and review processes (in part due to the overly light institutional framework) at two extreme scales: that of monitoring the impact of HCP's changes to the site over time and that of monitoring HCP's ability to protect the Outstanding Universal Value and other significant values.

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Mervat Ha’obsh

The process of designing a new protective shelter at Um er-Rasas, Jordan



The site

Um er-Rasas is an archaeological site, which started as a Roman military camp and grew to become a town from the fifth century AD: it contains remains from the Roman, Byzantine and Early Muslim periods (late third to ninth centuries AD). The archaeological park is located 30 km southeast of the town of Madaba on the Madaba plateau, one hour’s drive from Amman, just off the King’s Highway. It is in the middle of the desert area and the modern village of Um er-Rasas is situated to the west of the archaeological park and inhabited by Bedouin families. The park spreads over an area of 2 km² which includes: the Northern Settlement Area, which includes the Saint Stephen’s complex and the *castrum* (fortified camp); the Stylite Tower complex; and the Ancient Agricultural Fields that spread between the settlement and the tower, and are used by the Bedouins for grazing (Figures 1–2). The site is managed by a Site Management Unit under the Department of Antiquities and was inscribed in the World Heritage List in 2004 (Department of Antiquities 2002).

The archaeological remains belong to different periods, and have been dated on the basis of the artefacts discovered. A historical timeline for the site can be divided into the following periods:

1. Iron Age (seventh to sixth centuries BC)
2. Nabataean (third century BC to AD 106)
3. Late Roman (third to fourth centuries AD)
4. Late Byzantine (sixth century AD)
5. Abbasid (AD 750–1258)
6. The Jordanian village

In even earlier times, there seems to have been a Moabite town known as Kastrom Mefa’a. The prophet Jeremiah refers to the city as ‘Mephaath’ in his condemnation of Moab (Jeremiah 48:21). The name ‘Kastrom’ is recorded four times on mosaics discovered at the site and refers to a *castrum* or square walled town with very high walls supported by towers (Figure 3). The fourth-century church historian Eusebius of Caesarea (in his *Onomasticon*) recorded that a Roman army unit was stationed there.

A 15-m-high tower stands 1.5 km north of the *castrum*. The tower has no staircase and features curved crosses on its walls, which supports a theory that it was home to a Stylite monk or



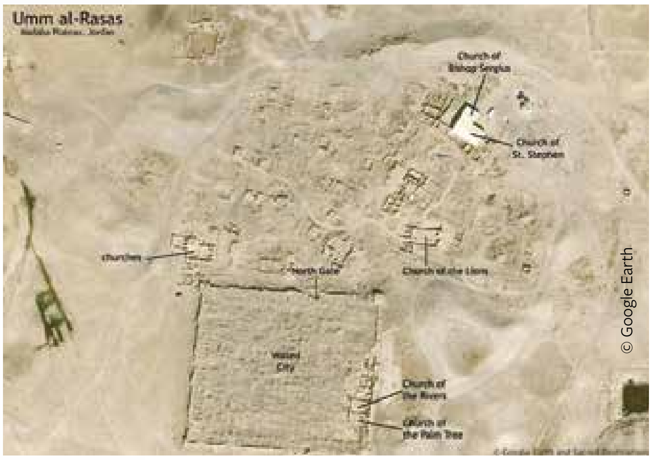




FIGURE 1 (top): General plan of the Um er-Rasas Archaeological Park.

FIGURE 2 (above left): Aerial view of the Saint Stephen's complex, which, in addition to the Church of Saint Stephen, includes the Church of the Aedicula, the Church of the Courtyard and the Church of Bishop Sergius.

FIGURE 3 (above right): The surviving circuit walls that surround the Kastrom Mefa'a.

'pillar saint'; a monastic practice that was known during the fifth century AD. This tower is the only intact example from this particular monastic movement (Figure 4).

Excavations conducted since 1986 have revealed the existence of many churches belonging to the Byzantine period and some of these were decorated with magnificent mosaic floors. Four churches have been excavated inside the walled town, while 12 churches lie outside the walls at the North Settlement. These include the Church of the Priest Wa'il and the Church of the Tabula to the southwest; Saint Stephen's complex to the northeast; and the Chapel of the Peacocks, the Church of Saint Paul and the Church of the Lions to the east. Some of these churches are well preserved and continued to be used into the Islamic period.

The area between the Stylite Tower and Saint Stephen's complex is known as the Ancient Agriculture Fields, which were originally created by terracing the *wadis* to the north, northeast and northwest of the *castrum*.

At the edge of the built area to the north of the *castrum* is a complex of four interconnected churches (the Church of the Aedicula, the Church of the Courtyard, the Church of Bishop Sergius and Church of Saint Stephen), which were built in the sixth and seventh centuries (Figure 5). These churches have been excavated by teams from Jordan (Department of Antiquities), Italy (Studium Biblicum Franciscanum) and Switzerland (Foundation Max von Berchem).



FIGURE 4: The Stylite Tower and its surrounding buildings; it seems to be the only intact example of a particular monastic movement that saw the tower as the home to a Stylite monk or 'pillar saint'.

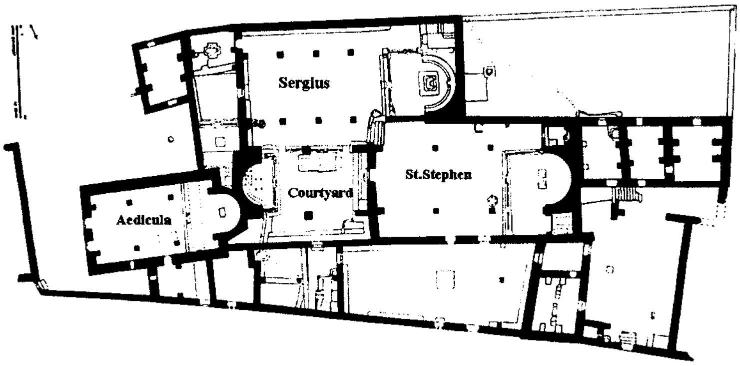


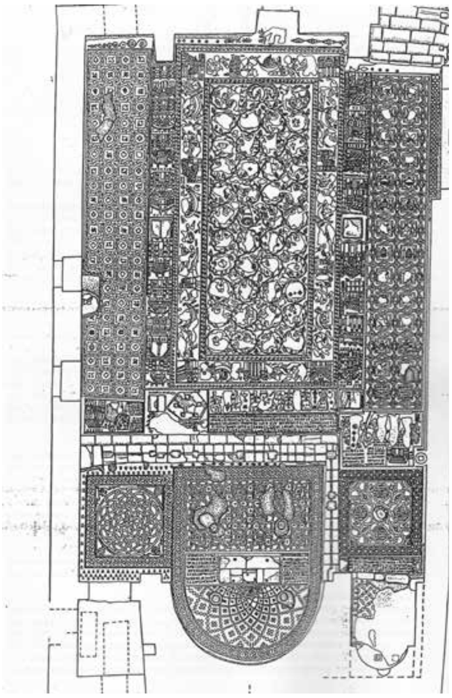
FIGURE 5: The layout of the four interconnected churches that make up the Saint Stephen's complex: the Church of the Aedicula, the Church of the Courtyard, the Church of Bishop Sergius and Church of Saint Stephen.

The following materials were used in the construction of the different buildings that exist on the site (either used separately or mixed together) and were identified during the excavations: phosphatic chert, coquina and limestone (all of which can be found in the quarries at Um er-Rasas), as well as black shale and gypsum, which would have been brought from Wadi Assir or from the Wadi Mujib area. The walls were made of a range of materials and were constructed without any lime mortar, in fact the name Um er-Rasas itself indicates this building technique.[1] The internal fill between the two wall facings is earth mixed with stone chips. The roofs, which provided protection for the buildings' walls, floors and plasters, were flat and supported on stone arches, covered with an earth mix.

Complex floor paving differs from one church to another. Mosaics are found at two churches, the Church of Saint Stephen and the Church of Bishop Sergius (Figures 6–7), and date back to the mid-eighth century, at the time of Bishop Job (at the end of the Umayyad period[2]), according to the inscription on the mosaic floor. Instead the floor of the Church of the Aedicula was paved with slabs of a local alabaster and the Church of the Courtyard was entirely covered with rectangular blue/grey 'gypsum' flagstones.

The total area of Saint Stephen's Church is about 305 m^2, and comprises three naves separated by two rows of arches resting on pillars and a raised presbyterium. The mosaics on the presbyterium floor have been dated to AD 785 and have the appearance of a well-woven and colourful carpet, set within a border that includes the names of the region's main cities: the cities of Palestine on the western border and of Jordan on the eastern border. A panel describing Jerusalem as the 'Holy City' is followed by panels naming Nablus, Sebastis (Sebastia), Caesarea, Diospolis (Lidda), Eleutheropolis (Beit Gibrin), Ashkelon and Gaza. On the border on the east side of the floor are nine ancient Jordanian cities, starting with a large double panel of Kastrom Mefa'a, followed by Philadelphia (Amman), Madaba, Esbounta (Hesban), Belemounta (Maeen), Areopolis (Rabba) and Charach Mouba (Karak). The inner frame of the mosaic, which depicts a river with fish, birds and water flowers, as well as boats and boys fishing or hunting, also portrays ten cities in the Nile Delta of Egypt: Alexandria, Kasin, Thenesos, Tamiathis, Panau, Pilousin, Antinau, Eraklion, Kynopolis and Pseudostomon. Many

1 The name is derived from the Arabic root *Rass*, which means the action of placing something on top of another in precise alignment; in this case the walls are built with stones laid one on top of another.
2 The Umayyad dynasty ruled the Islamic Caliphate from the mid-seventh to mid-eighth centuries AD.

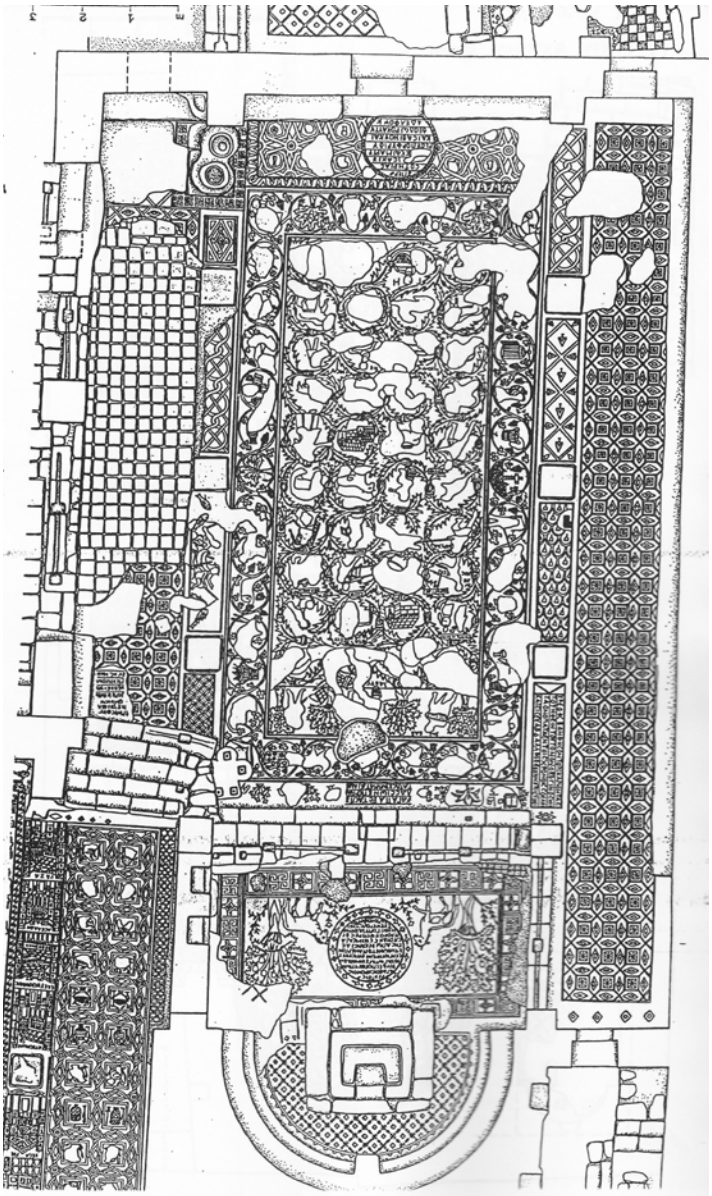


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FIGURE 6 (above and above right): The floor mosaic of the Church of Saint Stephen.



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FIGURE 7: The floor mosaic of Bishop Sergius Church.

of the mosaic's pastoral and hunting scenes have been carefully defaced by iconoclasts, the bodies and faces removed from history and delicately replaced with tiny white stones. The church also features an inscription mentioning Mount Nebo and the Memorial of Moses, and lists the names of wealthy benefactors who contributed to the new church floor.

The floor area of the Church of Bishop Sergius is instead about 320 m^2. Dated to AD 586, this structure is second in the chronological order of the churches built in Um er-Rasas and its plan was modified following the construction of the Church of Saint Stephen and the Church of the Courtyard. The entire floor of the church is covered with mosaics and a cistern is located underneath. The mouth of the cistern is visible between the central and southern nave, at the level of the first arch; the cistern mouth was integrated in the mosaic pavement and was used during the time the church was in use. The section of mosaics covered by the existing shelter were visible and preserved, with the remaining mosaics buried under 10–20 cm of sand. Ironically, the mosaics underneath the protective shelter are, in fact, in a critical condition where water has penetrated at the base of the shelter from the surrounding area outside, pooling on the paved floor. The white limestone tesserae can be seen to suffer from pitting and have heavy crusts and salt efflorescence as the consequence of water infiltration (Piccirillo 1993). The technique that was used for floor construction is a standard technique but the mosaic floor support needs considerable attention as it appears that poor quality mortar was used and that the ground under the mosaic was not sufficiently compacted.

The floor area of the Church of the Aedicula is about 155 m^2 and is paved entirely with slabs of local alabaster. It is supposed that this church is the oldest in the Saint Stephen's complex, with its construction being dated to the beginning of the sixth century.

The Church of the Courtyard has a floor area of about 150 m^2. This church has the unusual feature of a reversed apse, located to the west. This unusual plan is due to the fact that the building (probably an old transformed court) was inserted *a posteriori* between the Church of the Aedicula, the Church of Bishop Sergius and the Church of Saint Stephen. It is thus an additional building, which has been adapted to fit between the earlier structures. Its floor was entirely covered with rectangular blue/grey gypsum flagstones, including the floor of the presbyterium. The church appears to be much later in terms of the site's relative chronology.

Restoration work was carried out before the new replacement shelter was installed (see below). This included the restoration of the mosaics themselves, as well as the restoration and renovation of the church walls, following a detailed study and analysis of the existing situation. This analysis included architectural studies of the four different churches within the Saint Stephen's complex and research into the materials to be used for restoration. Mosaics were restored under the supervision of a mosaic specialist.

Spreading over an area of 2 km, visitors can easily look at the entire site from different viewpoints at the highest points around the site. However, the scale of the site means that visitors are required to walk some distance in order to arrive at the different archaeological buildings: the Stylite Tower and the *castrum* are two key points that demarcate the extent of the site. The old shelter on the site was enclosed on all sides, obstructing views of the site. The new shelter, however, is open on all sides and allows connections between the different sides of the site.

Um er-Rasas is located on the highest point of the Madaba plateau, between two main *wadis*, Wadi Wala and Wadi Mujib. There is no permanent running water supply available nor springs in the area. Water has traditionally been collected in watertight cisterns, open tanks and agricultural terraces in the bottom of *wadis*, which can be seen all over the archaeological site. Most of the water comes from storms, which although lasting only for short periods produce a large quantity of rainwater.

Um er-Rasas lies 34 km to the east of the Dead Sea Transform fault zone. According to the *Map of Natural Hazards* of the Munich Reinsurance Company (SECA 2001), the area of the

Mujib Dam, which is located only 11 km southwest of Um er-Rasas, is in earthquake hazard 'Zone 3'. This describes the probability of events with a certain strength occurring, in this case the hazard of an earthquake happening with intensity VIII on the Modified Mercalli Intensity Scale (corresponding to 6.2–6.9 on the Richter Magnitude Scale) and the risk is defined as: 'equivalent to one occurrence in 225 years (return period) on average'.[3] In fact, there were major earthquakes during the years 1900–98 which damaged the monuments.

Um er-Rasas has two seasons: summer, which is sunny, dry and hot, and winter, which is cold and rainy. Rain, mainly arriving with sudden storms, occurs in December, more frequently during January/February and ends in May. Winds mostly blow from the west and can be very violent (40/50 knots). When they arrive from the east, and more exceptionally from the south, they may be dusty, sometimes carrying red dust particles from Egypt. The temperature varies from about 0°C in winter (frost is exceptional) to 40°C and above in summer. Temperature is one of the parameters to be taken into account when planning sheltering and restoration work on the site.

Existing conditions and protective measures

The most critical issue on-site is the conservation of the archaeological remains, especially the mosaics. The key challenges here are: the large extent of the site; a lack of funding and a lack of specialists; insufficient awareness of the site's importance; unprogrammed excavation; and the absence of a clear action plan or maintenance programme. In addition, the existing shelter only partially covers the area of the Saint Stephen's complex. Other excavated churches on the site also suffer from a shortage of funds to cover their mosaics, which led to a decision by the Department of Antiquities to rebury the mosaics under sand in order to safeguard them. Additional measures taken to minimize the causes of decay on-site included a change to the Antiquities law to state that, 'no excavation shall take place within any archaeological area unless a clear conservation plan is planned and funded' (Department of Antiquities 2004). However, despite these efforts there is a need for more protective shelters at the other churches on the site and a shelter strategy should be developed, including a programme for their implementation.

A new shelter was built in 2009 to replace an existing one which covered part of the Saint Stephen's complex e.g. the Church of Saint Stephen and part of the Church of Bishop Sergius (the mosaics of the Church of Bishop Sergius not covered by the shelter were covered with a 10–20-cm-layer of sand for protection). The old shelter was enclosed on all sides and built on a 7.5-m-high structure made of a steel frame with a pitched roof supported by columns and lattice trusses approximately 4 m apart (Figure 8). The saddle roof was made of thin





FIGURE 8: The old shelter that covered part of the Saint Stephen's complex (the Church of Saint Stephen and part of the Church of Bishop Sergius).

[3] Jordan Valley Authority, Amman, personal communication.

steel plates painted a light yellow-green; the supporting walls sat on foundations outside the original walls within an unexcavated area. The shelter was lit and ventilated through glass windows, 4 m above ground level. Access to and from the complex was controlled through a single door at the west side of the complex, 1.20 m above ground level. While the old shelter protected the mosaics from weather conditions (rain, wind, dust, etc.), other factors related to the shelter directly contributed to damaging the mosaics. This included water infiltration from the shelter surface as well as water penetration underground, as a result of changes in topography and debris dumped near the complex which contributed to the creation of water pooling near the churches. The shelter had deteriorated and was in need of maintenance; rust could be seen on the shelter structure and trusses, and broken windows needed to be replaced.

In the old shelter, metal walkways were suspended from the ceiling. Built of steel, light yellow-green in colour, with iron railings, these indoor walkways were too high, meaning that the mosaics could not be seen clearly, and the visitor route was one-way as entry and exit was through the same door. Lighting and illumination within the shelter was poor; there was no lighting inside the shelter.

Example shelter

The new shelter at the Saint Stephen's complex, built in 2009, covers much more of the complex than the old shelter (Figure 9). The design of the new roof is simple, intended to evoke the characteristic roof of an ancient basilica. The new shelter helps to solve the biological deterioration affecting the mosaics in the apse of the Church of Saint Stephen. While the distinction between the ancient building and new structure is clear, it presents an impression of the original churches.

The shelter has a natural ventilation system thanks to the sides of the shelter being open (Figure 10). In addition, the shape of the roof assists natural ventilation and thus reduces problems of humidity, helping to reduce efflorescence phenomena on the mosaics. The new roof also has an efficient rainwater drainage system whereby water from the roof surface is collected via ditches and drains away down to cisterns or is channelled away from the complex. The load-bearing structure of the shelter is based on foundation pillars surrounding the Saint Stephen's complex walls, outside the perimeter of the churches. The new shelter works for the protection of the mosaics in general, however the mosaic floors continue to be covered by dust which obscures the mosaics' decorative scenes. In addition, as the shelter is open at the sides, birds can enter and their droppings negatively affect the mosaics.

FIGURE 9: The new shelter at the Saint Stephen's complex, built in 2009 – northwest elevation and south elevation.



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The process of designing the new shelter was a long one that went through several stages in order to identify a solution that met the needs of the site. The process began in 2001 when a mission report, delivered by the architectural conservation specialist Zaki Aslan, set out the criteria and recommendations for the shelter design (Aslan 2001):

1. ***Structural engineering.*** The new design should provide stable structural performance. Large spans with minimal supports. Modular structures are advised for future extension.
2. ***Impact of new structures on archaeological fabric and materials.*** The influence of a newly designed structure on archaeological material fabric is to be well studied; placement of foundations and footings should not harm historic walls and archaeological elements. Piling system is recommended for foundations.
3. ***Environment and microclimate.*** Local climatic prevailing conditions should form the base for providing a suitable microclimate inside the enclosure. Thermal and environmental performance of the structure should avoid occurrence of condensation, direct impact of light on the mosaics; and should provide possibilities of controllable natural light, shading devices, careful selection of insulation material, and glass with special reflective index and UV treatment. In addition, careful treatment according to orientation of the structure should be treated for wind-driven rain and dust, and impact of solar gain. Rate of air exchange has to be additionally defined.
4. ***Appearance.*** Aesthetic appearance of designed structures should be studied in association with the specificity and characteristics of archaeological remains and site, enhancement of site interpretation to clarify and enhance the values of the place of Mefa'a (Um er-Rasas), and the form which can achieve interpretative as well as environmental enhancements.
5. ***Use.*** The new design of protective structures at the site will have to avoid direct access to the mosaic floors and provide viewpoints from margins of rooms (e.g. via bridges). In addition, an assessment of carrying capacity within the shelter structure is required to evaluate the impact of visitor numbers on the interior climatic conditions and to ensure that the visitor route is designed to help them understand the original layout of the structure.
6. ***Safety of visitors*** has to be provided, and security inside the structure will have to be achieved to avoid possible looting and access of animals like sheep that very often frequent the area of Um er-Rasas. Use of fire-retardant materials is advisable.
7. ***Human and financial resources and material sources.*** The new design has to address and encompass aspects of cost, available staff at the site to manage the functionality of protective structures, and availability of building materials in the Jordanian construction industry.
8. ***Maintenance and durability*** of the new design should be of utmost importance in the choice of building materials. The new design will have to accommodate future necessary modifications and possible access to services for maintenance (e.g. scaffolding not to bear on ancient fabric) and simple interior roof design for maintenance with ease of access for cleaning. Provision of roof drainage into waste pipes (not soak away), although common sense, has to be stressed.

In addition, it was recommended that practical design parameters include as essential elements:

- full enclosure with roof and wall insulation with highly reflective external materials;
- improvement of outside drainage and rainwater dispersal;
- good controllable artificial lighting where necessary;
- controllable ventilation;
- effective door and window seals;
- access to archaeological features for routine cleaning and conservation;
- screens in ventilation points to prevent rodents or insects;
- ensure that fragile archaeological material is out of reach of the visitor access route;
- no walkway supports are placed on mosaic floors, and suspended dismountable tracks used for mosaic cleaning;
- blackout options on all windows.

The next phase of the shelter process involved a series of studies carried out to inform the design and preparatory measures were taken at the site to conserve and protect the archaeological remains. These actions included:





FIGURE 10: The interior of the new shelter at the Saint Stephen's complex, built in 2009. The shape of the roof assists the natural ventilation from the open sides and thus reduces problems of humidity.

- ***Topographical survey:*** a full topographical survey was conducted on the site, especially the area surrounding the complex, as a preparation for the study of water drainage. From the survey, detailed elevations and plans for the complex were prepared, with levels taken inside and outside the complex.
- ***Geophysical survey:*** to study in detail the condition of the mosaic floors in the Churches of Saint Stephen and Bishop Sergius, a geophysical survey was conducted by the Geophysics Division of the Natural Resources Authority of Jordan in 2005. The objective of the study was to: map buried structures; locate buried artefacts; identify target zones quickly, thereby reducing the required amount of costly excavation; and evaluate the applicability of geophysics as an archaeological aid in studying historic sites in Jordan.
- ***Total magnetic field, gravity, resistivity and GPR measurements:*** these measurements were all collected, although the use of other potential methods (magnetic and gravity) was restricted by the presence of the old shelter over the Saint Stephen's complex. The resistivity survey showed an area of low resistivity to the north of the complex, indicating an area of higher moisture content, and curved structures were identified below the Church of Saint Stephen.
- ***Test pits:*** these were excavated under the supervision of the archaeologist responsible for the site. Accordingly the decision was made to rest the shelter structure outside the complex's boundary.
- ***Conservation of the existing walls:*** the Department of Antiquities took the responsibility of conservation and consolidation of the existing archaeological walls, and to restore some of the arches and walls prior to the construction of the new shelter. Two professional workers from the Madaba Mosaic School were also involved.[4]

[4] The school has since become known as the Institute of Mosaic Art and Restoration.









FIGURE 11: Construction of the main new shelter structure, during which protective layers were placed over the mosaic floor.

Conservation works have been carried out using traditional lime-based mortars, taking into account the recommendations of the joint World Heritage Centre/ICOMOS mission of 2006 (Aslan 2001).

- ***Mosaic conservation and protection during and after construction:*** in order to preserve the mosaics before beginning to dismantle the old shelter they were cleaned and temporarily covered with protective layers. The layers consisted of: a sawdust layer used to cover the mosaic surfaces to absorb humidity; geo-textiles, nets and grit were used instead of polythene sheets owing to their high cost; a floor of wooden planks covering these layers was used as a level floor for the shelter construction site (Figure 11).
- ***Environmental modelling:*** this was conducted to inform decision-making on the shelter type to be constructed. Um er-Rasas is subject to significant contrasts between day- and night-time temperatures, as well as being exposed to winter rains and strong winds blowing from west and bringing dust. Accordingly the review committee took the decision to keep the shelter open on all sides for natural ventilation.
- ***Water drainage study:*** the topographical survey showed that the existing ground level next to the Church of Bishop Sergius is actually about 900 mm above the mosaic level, which explained changes in the natural drainage course of rainwater. Water pooling had been observed on the floor in the Church of Bishop Sergius during winter months. Dampness had also been observed on the north side of the Church of Saint Stephen, which was identified as the primary cause of damage to the mosaics. As mentioned

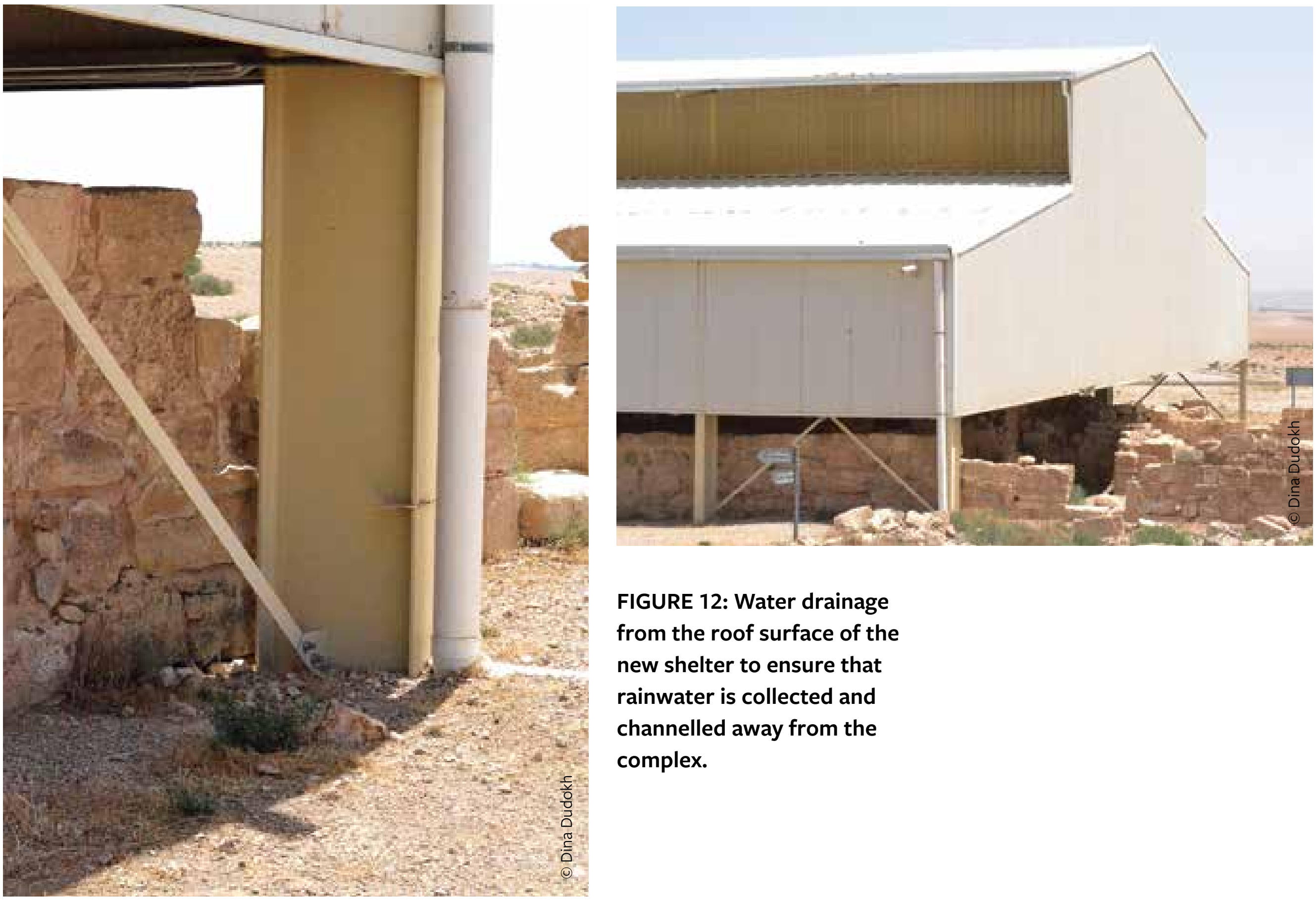


FIGURE 12: Water drainage from the roof surface of the new shelter to ensure that rainwater is collected and channelled away from the complex.

> above, in the newly designed replacement shelter, water from the roof surface is to be collected through ditches and discharged down to cisterns or away from the complex (Figure 12).

A preliminary design was commissioned from Société d'Eco-Aménagement (SECA), who described the shelter in these terms:

> 'The roofing principle adopts a plain lattice work system distant of 2.5m, carrying a large translucent polyester-PVC coated fabric covering above the central part and a corrugated thin steel sheet above the lateral part. That light roofing structure will be supported by simple masonry walls built over the antique structures in a way that minimises its visual impact on the site while simultaneously clearly differentiating modern structure from antique vestiges. The walls need consolidation; lime grout will be used to fill the voids… Building on the ancient walls will give the true dimension of the complex and will not endanger the archaeological area around the complex which was not excavated. Ventilating the structure will be through venting openings in the vertical part of the frame, a modular frame concept will be adopted to shelter all the churches on the site, walkways will be hanging from the structure 50 cm above the mosaic floor, water drainage will be through ditches down to cisterns' (SECA 2001) (Figure 13).

In 2003 Halcrow Group Ltd was awarded the contract to develop the design of the new shelter and a review committee was established from the main stakeholders (Department of Antiquities, Ministry of Tourism and Antiquities, UNESCO and a representative of the European Commission). Halcrow reviewed SECA's design concept and delivered a revised version (Halcrow 2005) (Figure 14) based on the same principles of the SECA concept to provide a new sheltering material (tensile cover). The idea behind using the tensile material was to address uncertainty surrounding the original height of the churches in the absence

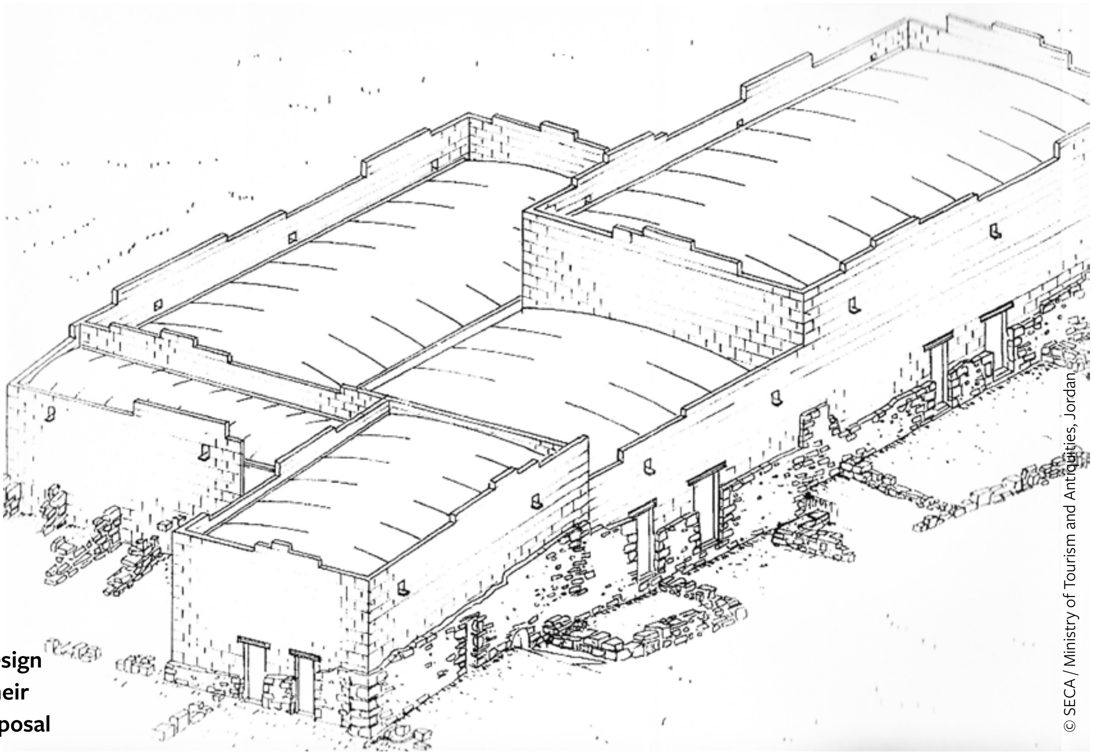
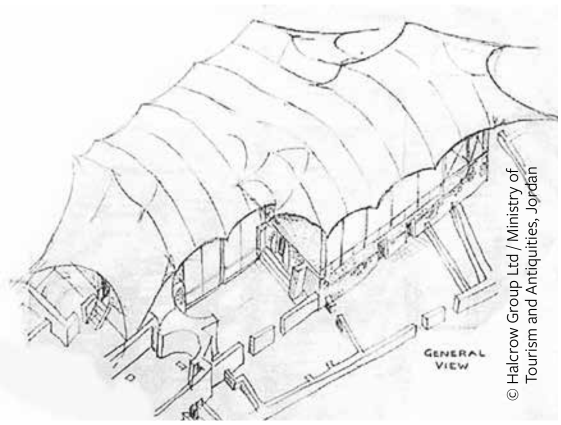


FIGURE 13: Concept design by SECA to illustrate their preliminary design proposal in 2001.



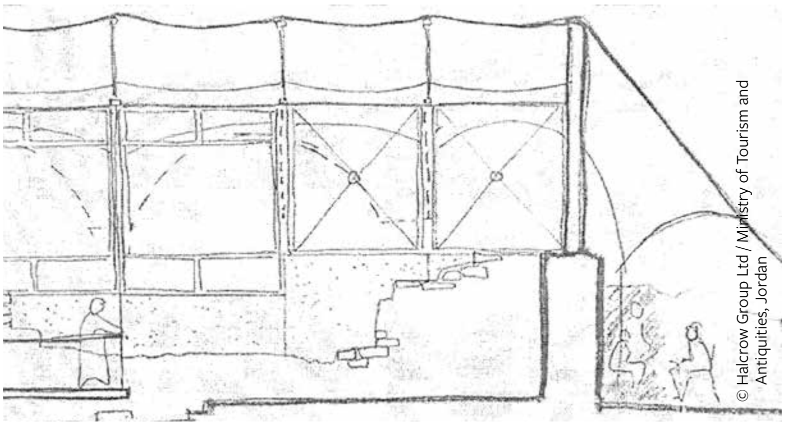


FIGURE 14: Concept design development from 2003, where the earlier 2001 proposal by SECA was revised following a review.

of any specific iconographical or archaeological evidence. The new design also proposed to introduce glass walls, so as to provide a transparent enclosure for the different churches.

This design was reviewed by the committee, which rejected the proposal for the use of glass and tensile covering for the shelter because of the high wind speed that the site is exposed to, and the negative impact that glass walls would have on the internal environment and on the condition of the mosaics.

The revised design subsequently presented by Halcrow featured a slightly inclined flat roof with a metal profiled sheet used as the roof covering. Four different roof levels were incorporated into the design – the highest roof over the Church of Saint Stephen and then, in descending order of height, over the Church of Bishop Sergius, over the entrance to the same church, and over the Church of the Courtyard. Except for the roof over the Church of the Courtyard, all rainwater would be carried through gutters and downpipes to the north of the complex and discharged to ground. The use of existing walls to support the structure was approved.

The method of connecting the steel structure to the existing walls would be through the use of a steel beam as the load spreader on a levelling concrete pad isolated from the existing wall. The walls would be a combination of glazing (fixed and openable) and render on metal lath. Render colours used would be different from those of the existing walls and be in contrasting

desert colours. Clear and non-reflective glass would be used for openings and as interior walls for the different churches.

The use of steel sheets were approved as a roof cover, the specification for the steel sheet being very clearly defined: gauge, profile, chemical makeup, coating system, holding-down system, method statements for installation best practice including touch up of coatings at bolt holes, etc. Preferred colours for this were desert tones.

The construction of the new shelter, which took place in 2009, had been revised and adapted according to the protection and conservation needs raised by the review committee. Furthermore, taking into account potential negative microclimatic effects, the idea of an enclosed shelter – with glass walls – was eliminated from the project, in agreement with the Department of Antiquities and the Ministry of Tourism and Antiquities. The proposal to build on existing wall structures had also been revised following further investigations by the building contractor, and it was agreed that the entire structure would be built outside of the boundary of the church complex.

Beyond the Saint Stephen's complex, a number of other churches that have been excavated at Um er-Rasas, and also have magnificent mosaics, have been studied and initial drawings have been prepared for providing protective shelters.[5] However, owing to a lack of funding this shelter project has been postponed. The mosaic floors are being documented and restored by experts from the Institute for Mosaic Art and Restoration of Madaba, and covered with soil for protection until appropriate shelters can be built.

The management context

Legal framework or mandate

The site is protected under Jordan's Antiquities Law no. 21 (1988 and its amendment by Law no. 23 of 2004; this replaced Antiquities Law no.26 of 1968).

The site was inscribed on the World Heritage List in 2004 and, accordingly, the World Heritage Convention and Operational Guidelines also apply.

Institutional framework

The site is the responsibility of the Department of Antiquities, which comes under the Ministry of Tourism and Antiquities. The Department of Antiquities works directly at Um er-Rasas through a Site Management Unit.

The site area is within the Municipality of Um er-Rasas. Urban planning around the site is responsibility of the municipality, while what is within the site boundaries is the responsibility of the Ministry of Tourism and Antiquities/Department of Antiquities.

The shelter works and the site are the subject of a development project known as the Protection and Promotion of Cultural Heritage in Jordan (PPCH), which took place from 2001–09. The overall objective of the PPCH is: 'to contribute to awareness and understanding of the country's cultural heritage, facilitate cultural exchange, and enhance the conservation of the cultural assets. It aims at maximizing, in a sustainable way, the benefit to Jordanians from the opportunities presented by the tourism sector and contribute to its development in general and to improve the preservation and awareness of Jordan's cultural heritage through enhanced site management capacity as well as protection and integrated presentation of another neighbouring site, Lehun'. The project has the following specific objectives:

- to support the Site Management Unit of the Ministry of Tourism and Antiquities;
- to assess training needs;
- to provide training to Site Management Unit staff in the establishment and follow-up of

[5] These structures are the Chapel of the Peacocks, the Church of the Lions, the Twin Churches, the Church of the Priest Wa'il and the Tabula.

site management operating procedures (including visitor management, interpretation, documentation, follow-up operations, safety project planning, and information functions);

- to provide training for the Um er-Rasas/Lehun site management team;
- to preserve and present Um er-Rasas;
- to establish the Um er-Rasas Archaeological Park and rehabilitate its ruins;
- to conserve the Saint Stephen's complex as a whole, especially the mosaic floors of the Churches of Saint Stephen and Bishop Sergius, the Chapel of the Peacocks and the Church of the Lions, and to execute the most essential infrastructure needed for the visitors including sheltering the Saint Stephen's complex;
- to prepare a technical study comprising final design drawings, specifications and tender documents for the necessary works;
- to undertake physical works for site preservation and accessibility and guidance for visitors, as defined in the final design;
- to supervise site works;
- to support the implementation of the national tourism policy – providing assistance to the Jordan Tourism Board.

Resources

No information is currently available on the specific amount of financial resources for Um er-Rasas as the budget is included within the overall Department of Antiquities budget. Other financial resources are sometimes available from the Ministry of Tourism and Antiquities budget or the Jordan Tourism Board for marketing the site. The specific shelter work was funded by the PPCH project, which had received finances from the European Commission in Amman.

With regard to human resources for the site, there is a Site Management Unit which coordinates with the Ministry of Tourism and Antiquities and the Department of Antiquities on site management issues. The Site Management Unit is made up of three specialists and six guards, who are responsible for all works on the site including the preparation of the management plan; these people are employed by the Department of Antiquities. A tourist police service is also available on the site as part of the Site Management Unit. Different teams are appointed for the various conservation projects.

Heritage processes

Planning is done internally by the Site Management Unit and the Department of Antiquities and approved by the Ministry of Tourism and Antiquities. Planning is carried out yearly, through a participatory planning approach that includes various stakeholders. At the end of the year a budget request is made to the Ministry of Tourism and Antiquities.

Any issue that requires conservation work is dealt with internally unless there is an agreement for excavation and restoration; other works might be done externally through tenders and contracts. Distribution of responsibility is defined according to the law. The Department of Antiquities is responsible for all archaeological sites, their protection, conservation and restoration, while inventory and information management are the responsibility of the Ministry of Tourism and Antiquities, and promotion and marketing of the site comes under the Jordan Tourism Board. NGOs and research institutions coordinate their activities with the Department of Antiquities and the Ministry of Tourism and Antiquities.

Under the management system, many actions have been undertaken to achieve management and conservation objectives, however the scope of these actions has been restricted by limitations of available funding.

The only formal monitoring mechanism that takes place at the site is in the form of World Heritage reactive monitoring and expert missions. Monitoring took place during the PPCH project cycle (2001–09) as a requirement of the funder, the European Commission.

About the author

Mervat Ha'obsh is an architectural engineer who works as a consultant for a wide range of heritage and urban development projects in Jordan. In 2002 she was the manager of the project for sheltering the mosaics at Um er-Rasas on behalf of the Ministry of Tourism and Antiquities.

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Moheddine Chaouali
and Hamida Rhouma

The usefulness of a shelter for the archaeological site of Bulla Regia, Tunisia

The site

The archaeological site of Bulla Regia is famous for the magnificence and wealth of its monuments (Figures 1–2) (Beschaouch *et al.* 1977; Chaouali 2010; Hanoune 1983). Some of these were excavated long ago and, having been exposed to the elements for decades, are now beginning to show an alarming state of deterioration. The aim of this chapter is, therefore, to illustrate briefly the importance of the various monuments at the site of Bulla Regia, before focusing on one of its features in particular, namely the mosaics, and outlining the solutions that are under consideration for their conservation.

The first evidence for the existence of the Numidian city of Bulla dates back to the fourth century BC. As early as the third century BC the city was under the influence of Carthage. In 202 BC Scipio Africanus, the Roman general who gained victory over the Carthaginians, took control of Bulla (Polybius, *The Histories* XIV, 9). Later in the mid-second century, the Numidian king Massinissa regained control of the city (Appian, *The Punic Wars* 10, 68), which became one of his many occasional royal residences.



FIGURE 1: Aerial photograph of the archaeological site of Bulla Regia.

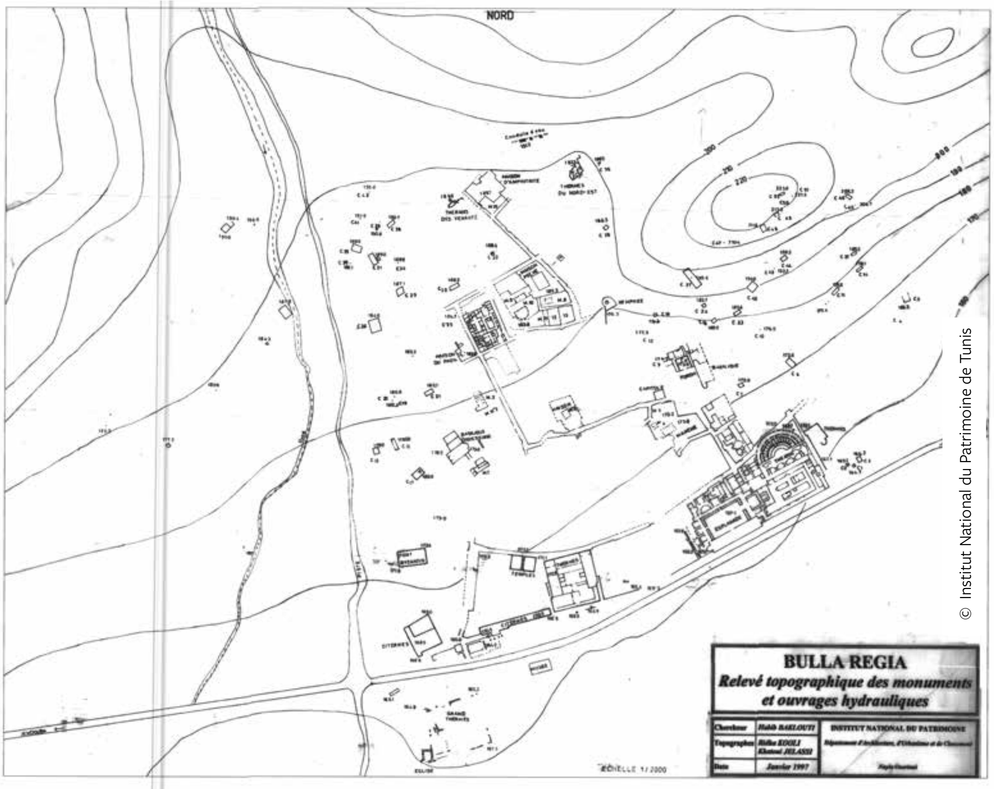


FIGURE 2: Map of the archaeological site of Bulla Regia.

During the Roman period Bulla Regia retained its name, reflecting its prestigious past as an occasional royal residence for Numidian kings, and some buildings and walls from this period are still visible today. Julius Caesar granted the city the status of *oppidum liberum* (Pliny the Elder, *Natural Histories* V, 22); it became a *municipium* under the Emperor Trajan between AD 110 and 112 (although the exact date may have been earlier under the Flavian dynasty); and it was later upgraded to an honorary colony under Emperor Hadrian (AD 117–138) with the formal name of *Colonia Aelia Hadriana Augusta Bulla Regia*. As the city gained in status over time it acquired monumental features as an architectural expression of its Romanization.

Not much is known of Bulla during the period when North Africa fell under the domination of the Vandals (AD 439–533). In the following period, during which Africa fell to the Byzantine empire (AD 533–698), Bulla Regia still retained some importance.

Bulla Regia has all the key features of a city and most aspects of life can be seen through its various monuments: the forum, civil basilica, triumphal arches, public baths (e.g. the Baths of Julia Memmia, the southern baths, the baths to the east of the theatre, etc.), sewers, latrines, nymphaea, aqueducts, cisterns, fountains, pools, a possible library, market, a theatre (Figure 3), an amphitheatre, and necropolises and tombs. There is also a Capitolium (dedicated to Jupiter, Juno and Minerva) and temples dedicated to Apollo, Isis, and Saturn, as well as others which are not yet identified.

Among the Christian monuments that have been discovered to date, of note are a double church, a peripheral church, a cemetery and dozens of Christian epitaphs. A mosaic discovered in 2010 depicts the story of Jonah,[1] and another a decorated mosaic shows the Four Rivers of Paradise with a biblical inscription. The so-called *Eglise du prêtre Alexander* can also be seen, in which a lintel was discovered with an engraved verse from a psalm.

Private life can be glimpsed in the existence of houses, some of which have underground levels, such as the House of the Hunt (Figure 4), the House of the New Hunt, the House of

[1] It is the only known floor of its kind, representing a canonical scene showing two episodes from the story of Jonah.

Amphitrite (Figures 5 and 8), the House of Fishing, and the House of the Peacock. The name given to a house states its principal feature, which is often the theme of a paved mosaic. Bulla Regia is famous for these magnificent houses with their underground floors, which are the site's main attraction.

In short, many impressive archaeological structures were found at Bulla Regia that reflect the refined taste and high standards of living of its inhabitants. There is no doubt that the people living there placed great importance on social display; with an emphasis on luxury, their wealth was displayed through the mosaics that decorate the various houses. In fact, excavations have revealed some 370 such floors decorating different buildings, and it should not be forgotten that many more would have existed that have not survived.

Existing conditions and protective measures

However, today this rich repertoire of images preserved *in situ* is increasingly at risk. For some years a multidisciplinary team has been monitoring the state of conservation of these floors, while planning for the safeguarding and enhancement of the site. It should be pointed out that the site of Bulla Regia is not an isolated case within Tunisia's heritage management system, as all the archaeological sites in Tunisia have been subject to the same risks since they were uncovered by the early European explorers and this soon becomes obvious during a visit to any Tunisian site. Generally, approaches to the restoration and conservation of decorative floors are the same throughout Tunisia.

In the case of Bulla Regia it is important to take into account that most of the floor mosaics that can be seen today were uncovered during the major excavation campaigns carried out between the end of the nineteenth century (under Louis Carton) and the beginning of the 1980s (under Pierre Quoniam and Mongi Bouloudnine). Calls for their conservation began





FIGURE 3: Among the many public buildings at Bulla Regia there is a Roman theatre.

FIGURE 4: The houses at Bulla Regia are famous for their underground residential levels laid out around a courtyard; here the lower ground floor of the House of the Hunt can be seen from ground level.



FIGURE 5: The House of Amphitrite is famous for its impressive mosaic floors; here in the *triclinium* and corridor of the house a human face can be seen in the foreground of the mosaic and, behind, the famous Venus mosaic *in situ*.

in the 1970s, with the first experiments carried out by a French-Tunisian mission; although a lack of experience in this area can be seen in the weaknesses and inconsistencies of their restoration. Several mosaic floors were lifted and re-laid either in a lime mortar bedding on a metal support or on reinforced concrete panels (Figure 6). Nowadays more reliable techniques for conserving *in situ* mosaics are used, which respect the authenticity of the decorative scenes and are in line with international practice.

There are three main risks that threaten the mosaics in Bulla Regia today. First, human damage is inevitably caused by the impact of thousands of visitors on-site all year round. In addition to the carelessness of some visitors there is the wilful, and sometimes irreparable, vandalism, such as the removal of tesserae. Second, there are biohazards: one of the main causes of decay of the Bulla Regia mosaics are microorganisms (moss, lichens, etc.) and vegetation. Finally, natural risks include alternating wet and dry cycles, which lead to salt efflorescence on the surface of the mosaics causing the tesserae to detach.



FIGURE 6: Use of reinforced concrete as a support for a mosaic in the so-called *Augusteum*.

Therefore, one key concern is to create more favourable conditions for the mosaics so as to minimize decay and thereby extend their lifespan. Several approaches are currently being taken, including stabilization (cleaning the floor and removing accumulated dust, concretions and microorganisms in order to make the mosaic more visible; reinforcing edges; consolidating and improving tesserae adhesion by injecting liquid mortar; filling lacunae, etc.) and reburial with netting and sand to prevent the growth of vegetation or contact with water (which has been carried out for House 9).

Example shelter

While many Mediterranean countries (e.g. Italy, Turkey, Greece, Spain) have chosen to use shelters to maximize the protection of their archaeological sites, this approach has never been taken in Tunisia. Only two shelters are significant enough in this context to mention: the first was built in El Jem, the ancient city of Thysdrus in the Sahel (in the central western part of Tunisia), while a second shelter can be found in Nabeul, the ancient city of Neapolis in Cap Bon (in northeast Tunisia).

However, having examined the results achieved at other Mediterranean sites, including within the context of the symposium held at Herculaneum which is the subject of this publication, it has been concluded that a new approach to the conservation of *in situ* decorative mosaics by installing protective shelters is now, more than ever, essential. Thanks to the support of the Getty Conservation Institute and an agreed generous donation from the World Monuments Fund, a process is now underway with professional input. Following long working days and intense discussions both on-site at Bulla Regia and at the National Heritage Institute in Tunis, where ideas have been debated, it has now finally been agreed that two shelters will be constructed. This will ensure greater protection of *in situ* floors from the various risks mentioned above. The first shelter will cover the *triclinium* and vestibule on the ground floor of the House of the New Hunt using a metal structure open on the sides (Figure 7). The second will follow the form of the original vault over the *cubiculum* of the House of Amphitrite (Figure 8); reburial of the geometric mosaic in this room is being considered. A system for draining rainwater would also be included in these works.







FIGURE 7: The *triclinium* of the House of the New Hunt with its high-quality mosaic floor (above left and below left). A new protective shelter is being planned here that will also cover the vestibule area (above).

In conclusion, one of the values of Bulla Regia is the fact that the site offers significant insights and provides greater understanding, not only of the history of Tunisia, but of the whole of North Africa. As such its mosaics have now become the subject of great interest within the conservation sector. The installation of shelters will probably be one of the most efficient means to ensure that the legacy of these mosaics is preserved for future generations and preventing them from suffering any further damage.

The management context

Legal framework or mandate

The legal framework for the management of cultural heritage in Tunisia is Law 35 of 24/02/1994 for historic and archaeological heritage, and traditional arts. In addition to identifying the heritage it lays out the responsibilities of the ministry in charge of heritage (Ministry of Culture) and defines the tools at its disposal for legal protection (e.g. the listing of historic monuments) and management (e.g. plans for safeguarding and enhancing historic complexes).





FIGURE 8: The *cubiculum* on the lower-ground floor of the House of Amphitrite, where a protective shelter is planned.

Institutional framework

The Institut National du Patrimoine (INP) is the public heritage authority, under the Ministry of Culture, which is responsible for managing and protecting archaeological sites and other heritage. An annual action plan is drawn up by the team on-site, which is made up of architects, archaeologists and conservators. This plan is then approved by the INP's Division for the Preservation of Monuments and Sites. The action plan lists the priority actions and conservation projects to be undertaken during the year and budget estimates for these projects. The INP allocates budgets according to priorities. Management is not limited to projects within the site, as the INP is also responsible for building and development permits around the site.

Resources

In order to address the conservation problems discussed above, the INP in Tunis has provided human and financial resources and developed partnerships with institutions specializing in the conservation of archaeological sites (e.g. the MOSAIKON programme; Michaelides 2011). In the archaeological site of Bulla Regia there is a multidisciplinary team consisting of: one researcher, one architect, two conservators, three mosaic technicians, one masonry restorer, and ten custodians (two shifts working day and night).

The financial resources for maintenance, conservation, vegetation management, security, etc. come from the budget of the INP. The Agency for the Development of National Heritage and Cultural Promotion is virtually non-existent in all these efforts. Fortunately, a budget of TD 55,000 (dinar) was allocated by the INP to the site for the year 2014.

It should be noted, however, that the human and financial resources made available for Bulla Regia are insignificant in comparison other more favoured Tunisian sites.

Heritage processes

The team at Bulla Regia, with its in-house architectural and archaeological expertise, draws up an annual action plan for site activities. This action plan includes various restoration projects according to the state of conservation of the monuments and according to visitor access. The plan also includes emergency works, i.e. the consolidation of those monuments which are in a critical state of decay. The conservation of the *in situ* mosaics (more than 380 pavements) is always a priority in site planning. In addition, documentation and diagnostic work are always included. Budgeting for the various activities to be undertaken is an important element of the action plan. The identification of relevant human resources is fundamental for better management.

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Erdem Soner Bellibaş

An assessment of the protective shelter of Terrace House 2, Ephesus, Turkey

The site

The ancient city of Ephesus is located on the Aegean coast of Turkey, near the town of Selçuk, 80 km south of the city of İzmir. The ancient city, which was once a harbour city where the Kaystros river joined the sea, is now found 9 km inland as a result of alluvial deposits which have filled the harbour (Figures 1–2). Excavations at Ephesus have been undertaken by the Austrian Archaeological Institute.

The first settlements found in the region date back to Neolithic period. The city, as we know it today, was built in the latter half of the second millennium BC. Built as an Ionian colony, the city was transformed into one of the most important and rich harbour cities in Asia Minor



FIGURE 1: Aerial view of Ephesus.

in the Hellenistic and Roman periods. Being a harbour city which connected east and west and having its own importance within Asia Minor, it also played a key role in the development of the early Christian church.



FIGURE 2: Satellite view showing the relationship between the site of Ephesus (in the centre of the image) and the nearby modern town of Selçuk to the right.

After the Persian and Arab attacks of the sixth and seventh centuries AD and a sweep of contagious diseases, mainly borne by insects occupying the marsh area that developed where the harbour had been, the settlement relocated towards the Basilica of Saint John and Ayasuluk Hill. Seljuk Turks conquered Ephesus for the first time in the beginning of the eleventh century, although the city once again fell to Byzantine rule shortly afterwards (Külzer 2011: 33; Foss 1979: 117–118). In the following centuries the area did not develop as much as it had in early antiquity. Regeneration and architectural activity would not take place again until the fourteenth century, under the rule of the Aydınoğulları Beyliği and the early years of the Ottoman Empire. After the sixteenth century the city started to lose power again under the Ottoman reign, when it began to be overshadowed by the neighbouring towns of Kuşadası and İzmir. There was little architectural development from that time until the Turkish Republic was founded in 1923.

The city contains Hellenistic, Roman and Byzantine period features, as well as important Christian monuments, such as the House of the Virgin Mary, Saint John's Basilica and the Church of Saint Mary, and also significant Turkish period monuments, such as the İsa Bey Mosque (Figure 3).These features and monuments make Ephesus one of the most culturally significant ancient cities in the Mediterranean region.

The archaeological area that is open to visitors today is located between the Panayırdağ (Koressos) and Bülbüldağ mountains, a few kilometres off the busy İzmir road. The site is visible from the road, including the great theatre, which can be seen by those passing. The structure that can be seen most clearly, however, is the protective shelter that has been installed over the Terrace House complexes, which will be discussed in this chapter (Figures



FIGURE 3: Significant places within the site of Ephesus include the Temple of Artemis, Ayasuluk Hill and İsa Bey Mosque.





FIGURE 4 (above left): This aerial view shows Ephesus within the landscape at the foot of the Panayırdağ hill.

FIGURE 5 (above right): View of the theatre and the Terrace House complexes at Ephesus from the main road. Note the visual impact of the white shelter covering the Terrace House.

4–5). The site can also be observed from above (parachute jumping organized by the local commercial airport is a very popular activity), and from the heights of the city itself: the protective roof is also clearly visible from the theatre, which has a view of the city, and from the odeon which is located near the upper entrance.

Existing conditions and protective measures

The main conservation challenge at Ephesus is the management of a large number of stakeholders given the absence of any legal clarity in the definition of responsibilities for conservation work, which results in confusion and a lack of coherency between stakeholder activities. This means that only the most urgent issues are addressed and there are significant delays for other necessary preventive works, incurred whilst waiting for a stakeholder to intervene, until they too become urgent.

Another very important issue is the current amount of conservation work. Excavations, which have been carried out for over 100 years, have exposed too many structures without any efficient protection put in place. It would not be inaccurate to say that even today the situation has not changed much: excavation proceeds, as in many other sites in Turkey, much faster than conservation work. Moreover, there is a serious amount of decay in the cement-based 'restorations' of the past, which require significant attention within overall conservation planning.[1] Tourism at the site, which places enormous pressure on the archaeological remains, is another issue where there are conflicts with conservation needs.

It is difficult to talk in terms of a site conservation management plan as there is a limited on-site conservation team with a restricted budget (compared to the size of the site) making repairs in the areas most at risk, primarily those that may be dangerous for visitors. The main, but not only, reason for such a small conservation team is due to the limited budget. Private sponsors usually prefer investing in one-off projects for larger monuments, which are particularly significant or historically important, instead of spending money on consolidation and repairs, which are essentially invisible to the visitor.

Impacts from visitors are being addressed within a visitor management plan for the whole site, prepared by the Ministry of Culture, which is being executed and monitored by the Ephesus

1 Tekin (2013); see also Österreichisches Archäologisches Institut (2014) for recent building conservation studies in Ephesus, concerning difficulties caused by previous interventions.

Museum. This includes a visitor routes project that is currently underway and which aims to reduce the impact of visitors as they walk through the site.

Around the site many small basic shelters can be found, which have been constructed ad hoc by the archaeologist or the chief workman who was responsible at the time for a particular excavation. There is also one large shelter covering an area of large finds fragments that acts more like an on-site depot. The only large-scale, well-planned shelter is over Terrace House 2, thus it is difficult to talk about any kind of shelter typology in Ephesus.

Example shelter

The Terrace Houses are two similar Roman *insulae*, dating to the first century BC, located on the northern slope of Bülbüldağ in a very central point where Curetes Street and Marble Street meet, and where the Celsus Library is also located. Excavations carried out by the Austrian Archaeological Institute started in Terrace House 1 in the early 1950s and later in the late 1960s on the stepped street between the two *insulae*, and to west of it, Terrace House 2 was discovered (Krinzinger 2000a). The *insula*, approximately 4,000 m² in size, contains seven housing units distributed over a number of terraces. The highly rich-decorated interior of the *insula* makes it one of the most important examples of domestic culture from the Mediterranean region. Such domestic luxury is almost comparable with the examples of Roman sites like Pompeii or Herculaneum (Figure 6).

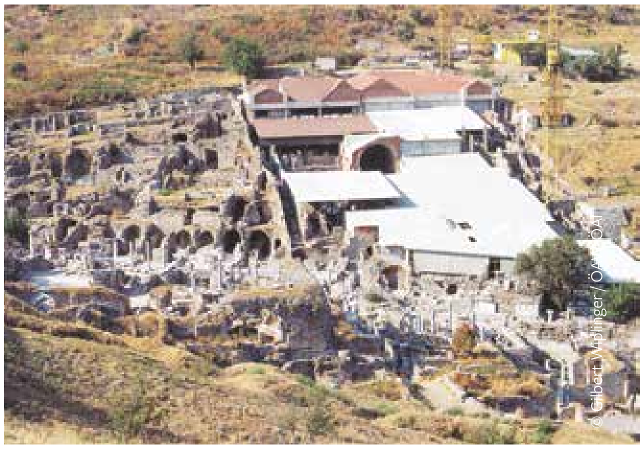
Following international approaches that give importance to *in situ* protection, immediately after excavation it was decided to conserve Terrace House 2 and the construction of a first protective shelter began. Reconstruction of the roofs was planned based on the ground plans of the rooms and allowing daylight into the peristyle courtyards, giving an impression of the original state of the housing units in antiquity (Figure 7).

Unfortunately, the project was a disaster in many ways. Firstly, the units were not as well preserved as in Pompeii or Herculaneum and thus did not provide enough information on the original architecture, causing highly speculative decision-making. Secondly, the extreme use of reinforced concrete is now irreversible without harming the monument; some large portions of the



FIGURE 6: Interior view of the shelter over Terrace House 2, from within housing unit 3, room 12.

FIGURE 7: The old (1985) shelter over housing units 1 and 2 of Terrace House 2 and temporary shelters over the other units.



implemented concrete beams, which could not be removed, are still visible today. The project was also unsatisfactory in terms of the need to maintain particular climatic conditions both for visitors and the archaeological remains. There were problems of water infiltration as well.

Therefore, in 1986 it was decided to stop construction even though shelters had only been erected over housing units 1 and 2. Later, the rest of the *insula* was temporarily covered with metal roofing sheets supported by a wooden structure while a design competition was held to find a new proposal. The new proposal was essentially for a huge reinforced concrete roof, covering the whole *insula,* and it was planned to cover this structure with vegetation. However, the project was not approved and was never executed (Krinzinger 2000b).

In 1995, under the directorship of Friedrich Krinzinger, a new attempt was made that resulted in the construction of the existing shelter that is visible today. The shelter was built by the Austrian Government and Austrian Archaeological Institute and was co-funded by several sponsors. Construction cost 60 million Austrian Schillings, which is approximately €4.3 million, and was completed in the year 2000. The main design concept was based on the principles of the Venice Charter, including the importance of using modern materials that are distinguishable from the original (Krinzinger 2000b). The planners wanted to develop a very light construction built using modern technologies with the aim of achieving the necessary climatic conditions for optimum protection and the precise balance of humidity and temperature needed inside the complex. The aim was that the new structure would not impact on the archaeological remains or the natural environment, nor would it compete visually with the ruins. The structure was planned to be inserted into the landscape on the same inclination and levels as the insula when approaching both from Curetes Street and Marble Street (Häuselmayer 2000; Achleitner 2000) (Figure 8).

Three basic types of material were used for the construction (Ziesel 2000):

- ***Structure:*** a high-grade stainless steel structure, which is non-corrosive and therefore durable without maintenance.
- ***Roof skin:*** a membrane stretched over the structure, made of fibreglass and polytetrafluorethylene, which is light, highly resistant, waterproof, self-cleaning and translucent.
- ***Façade:*** a transparent material offering impressive visibility, both of the interior and exterior of the *insula*, made of the polycarbonate LEXAN. These polycarbonate plates, together with the translucent roofing, allow natural light to enter the whole complex efficiently. Placed at an angle, like shutters, they also provide effective natural ventilation

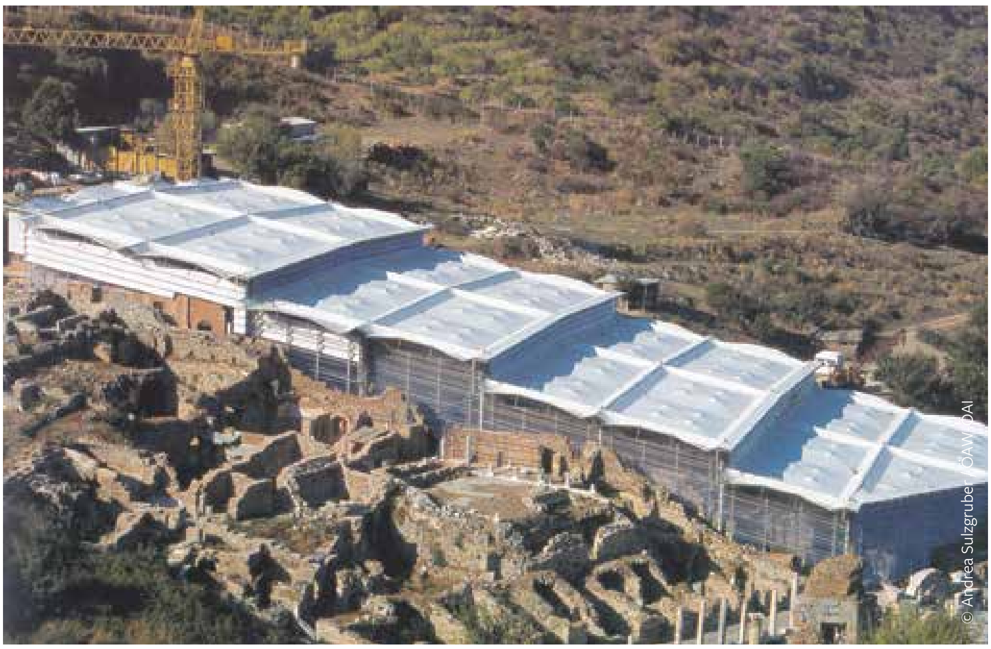


FIGURE 8: Eastern view of the shelter over Terrace House 2 as seen from the theatre.

for the interior. Some of the plates were intentionally non-transparent to avoid too much direct sunlight (Figure 9).

The structure stands on four levels, three of which are made of four main frames, each 25 m by 11 m, and one triangle frame at the northeastern corner. The frames are divided into two equal sections with a lighter beam and the membrane is stretched over them. At the request of the archaeologists the northeastern corner was designed differently as a single unit with its own entrance as there is a Byzantine stone saw mill workshop there, specifically set up for the marble work of the insula, and the intention is to turn this area into a special museum in the future (Häuselmayer 2000). With additional half-frames the structure also overhangs on the four sides, providing shade and shelter for the visitors, especially for those using the two stepped streets.

Two rows of steel pillars are placed along the stepped streets, sitting on reinforced concrete foundations. These pillars are equally distributed along the sides of the structure, each coinciding with the corners of the frames above them. Challenges were faced during the design stage when considering how to place the pillars on a central axis because the mosaic floors could not be compromised. A successful solution was found by replacing one long beam along the structure, also shaped by the section of the insula. This beam functions like a backbone, is carried by pillars placed in points wherever possible, and forms the central axis of the structure (Ziesel 2000) (Figure 10).

Ephesus is visited by more than 1.5 million people every year. An extra entrance fee is required for Terrace House 2 and it costs almost the same amount as the site entrance fee, which limits the number of visits to this *insula*. This may well be a very effective protection strategy but the money goes directly to the Ministry of Culture and is not used to fund the conservation needs of the monument. A system whereby the income from the tickets to the Terrace Houses goes directly to cover maintenance and conservation costs would be the ultimate solution and contribute to long-term management strategies.

FIGURE 9: Southern view of the shelter where non-transparent panels were used to avoid too much sunlight.





FIGURE 10: Interior view of the shelter over Terrace House 2, from within housing unit 5, room 24.

Generally speaking, the shelter is efficient. It successfully provides a perfect climate both for visitors and for the archaeological remains. The shelter also allows conservation works to continue all year round within this area, which significantly helps overall conservation efforts.[2] The visitor walkways, which were installed after the shelter was completed, are also very effective. They allow the visitors to access and to view almost every room, while safeguarding the mosaics from being stepped on and the frescoes being touched. The visitor platforms, with information panels on the archaeology of the *insula*, also provide impressive overall views. The only problem concerning the walkways is the handrails, which currently accumulate an unacceptable level of static electricity and should be replaced with wooden ones.

As mentioned above, one of the main advantages of the shelter is that it requires minimum maintenance. In practice, both the membrane and the steel structure are maintained on an annual basis, although the side plates are not. Dirt or atmospheric damage have turned the plates non-transparent, which unfortunately conflicts with the basic design approach (Figures 11–12).

Another design flaw is that the openings left in the shell of the construction were not assessed in terms of accessibility to wildlife and as a consequence a problem of pigeon guano occurred. Managers of some sites try to solve this problem by keeping a bird of prey on site. In the case of Ephesus, occasionally, a natural solution happens: a family of owls makes its home there and the owls hunt and scare the pigeons away.

The main critique of the shelter, however, is the question of whether the structure is really harmonious with its setting and does it compete with the very structure it is protecting? Trying to take an objective view it can be said that, looking from within the shelter, it does not

[2] Please see Österreichisches Archäologisches Institut (no date) for further information on the conservation works in the *insula*.





FIGURE 11 (left): Interior view of the shelter over Terrace House 2 immediately after construction was completed and when the transparent side panels provided good visibility of the monuments outside on Curetes Street.

FIGURE 12 (above): A more recent photograph of the interior of the Terrace House 2 shelter; note that the side panels have become non-transparent over the years.

compete nor is it disharmonious with the archaeology and it does provide a good environment for visiting and working. However, in particular because of the concept of inclined levels that imitate the *insula* slope, the whitish skin of the roof is very visible when approaching from Marble Street or even from the modern main road to İzmir. Until the shelter was built the only structure visible from this point was the theatre.

Finally, a broader criticism of the shelter is based on the fact that although more than €4 million was invested in one particular project, the site itself does not have an ongoing conservation plan. Terrace House 2 is certainly more richly decorated than Terrace House 1, but how ethical is it to use such a significant amount of resources for a single monument and leave its neighbour to decay?[3] This fact raises a question about whether the main motivation for the project was perhaps based more on political factors than on conservation concerns.

The management context

Legal framework or mandate

The site is subject to international treaties, such as the UNESCO World Heritage Convention (as it is on the tentative list for World Heritage status); the Convention for the Protection of the Architectural Heritage of Europe; and the European Convention for the Protection of Archaeological Heritage.

At a national level the key piece of legislation is Law 2863 and also of note are:

- Law for the protection of cultural and national heritage and its by-laws regarding the implementation of Legislation 2863;
- Resolution 658 (Archaeological Sites, protection and usage conditions);

[3] See Özgönül (2001) for further critiques.

- Resolution 714 (replacing Resolution 572, regarding the protection of unearthed finds and their exhibition, and the planning of visitor utilities, such as parking lots and restrooms);
- Resolution 715 (regarding the applicability of Resolution 701 'for the construction of temporary shelters and visitor utilities in beach areas', which is also applicable to archaeological sites);
- Resolution 745 (regarding the use and rent of archaeological sites to corporations and persons).

There is also a range of partnership agreements in place for each project on-site with related sponsors. Furthermore, there are municipality laws and tender laws that apply. Regarding the political climate in Turkey at the time of writing, the whole legal framework, especially Law 2863, and tender laws are undergoing many changes, which may or may not render some of the items above obsolete in the future.

Institutional framework

The General Directorate of Museums and Excavations is the unit responsible for the site on behalf of the Ministry of Culture. For some specific areas of the site, the General Directorate of Foundations (in charge of Turkish/Islamic monuments) replaces the General Directorate of Museums and Excavations in terms of responsibility.

The ministry's partnership agreement with the Austrian Archaeological Institute, which is renewed every year, in turn gives responsibility to the Austrian Archaeological Institute for conservation and research at the site. Conservation works and research are carried out with constant monitoring from the Ministry of Culture in the form of public officers who monitor works in progress.

The Ephesus Museum, as an extension of the General Directorate of Museums and Excavations is responsible for visitor management and for commissioning or planning for site infrastructure (such as fences, visitor paths, landscaping, etc.), which in reality creates a fragmented approach to the site. Conservation works are kept separate from presentation works, thus creating a less effective visitor experience.

The running of the ticket office and gift shop has been outsourced by the General Directorate of Museums and Excavations to Bilintur, a private company, as is the case at many other sites.

The Ephesus Foundation is a key stakeholder; it was established by some of Turkey's larger private corporations and benefits from the tax exemption given in exchange for cultural investments in Turkey. It has provided strategic partnership for the Ephesus excavations. There are also temporary partnerships with charitable foundations from around the world for specific projects (for example, for the conservation of Saint Paul's Grotto, the wall paintings of the Terrace Houses, the conservation of the theatre, etc.), which end once the project in question has been completed.

Resources

The general annual budget is not transparent, however it covers the excavation season and some permanent staff. Conservation projects receive approval after funding has been obtained from sponsors, with some contributions made by the Austrian Archaeological Institute. Sponsorship is made easier for private sector investors and foundations, as in the case of the Ephesus Foundation, which provide some funding for conservation projects, or the Friends of Ephesus Society from Austria, which makes donations to the site. However, funding obtained from government institutes is harder to spend due to legislation that requires almost all works to be commissioned out through a standard tender process: archaeological sites have particular requirements that are not recognized in tender legislation, which does not define necessary specifications or qualifications for such works.

There are about ten permanent staff at the site with roles ranging from management of the excavation house to on-site guards, all of whom are contracted through the Austrian Archaeological Institute. The excavation season (May through November) sees the arrival of around 100 temporary staff members and researchers who stay for approximately one and a half months each year. Around 50 excavation and conservation workers are employed every season.

Heritage processes

All planning is done internally and on a project basis whereby each project plans ahead on a five-year basis. Each five-year plan is submitted to the Ministry of Culture for approval and this plays a major role in obtaining yearly excavation permits. The planning approach is thematic.

Results are achieved using internal personnel where possible, under the full responsibility of the Austrian Archaeological Institute. In special cases outsourcing is necessary, however it is the Austrian Archaeological Institute again which is responsible for monitoring and managing the correct implementation of works. As explained above, it is usually in the best interests of the site to avoid tendering out services in order to ensure a level of quality.

The current system of management can manage stand-alone objectives, such as the conservation of a single monument. However, a lack of coordination among stakeholders, who have separate responsibilities for conservation works, site planning and visitor management, and the existence of legal frameworks that do not facilitate coordination, make it difficult to operate on a site-wide scale when stakeholders want to perform their duties separately. However, the nomination process for World Heritage status is seeing greater coordination as part of a new management system, which shows promise for the future.

About the author

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Part 3
Insights into Mediterranean practice





Alaa El Habashi

Muharraq Souq, Bahrain

The site

This chapter describes the *madbasas* that are privately owned by the Siyadi family and located within the traditional market (*souq*) of the city of Muharraq in Bahrain. These historic structures were built into the floors of small shops that collapsed sometime after the 1970s, following which the land was abandoned and used illegally as informal parking for the market. The Siyadi family is famous in Bahrain for having been prominent pearl merchants when this industry was the basis of the country's economy (up until the 1930s when cultured pearls began to be developed in Japan and the industry gradually declined in Bahrain).

The site is a small section of the traditional market of the old city of Muharraq. It and other neighbouring shops are registered as a national monument, thus subject to the protection of local antiquities law. The site, along with sixteen other urban properties in the old city, was inscribed as a serial site on the World Heritage List. Each shop structure measures about 3 m by 7–9 m deep. Excavations revealed that most of the shops in this area of the market used to sell date molasses. The molasses was made within the shops in floor conduits constructed out of coral stone and plastered with lime/gypsum-based mortar. These conduits sloped down to a sunken jar, a system that is locally called a *madbasa*. The molasses was extracted by pressing packed sacks of dates and it then flowed down to the jar where it was collected and sold. It is not clear until when the floor conduits were still in use but the shops where the *madbasas* were found were certainly functioning up until the 1970s.

Excavation has revealed that most of the shops in this area of the market had a *madbasa*, pointing to the possibility that they were exclusively selling date molasses, and this hints at the large number of date palm trees that historically existed in Bahrain, which was known as being a country of 'a million palm trees'. Therefore, the site not only has values related to a traditional industry but also provides clear evidence of an important historic fact: that fresh water springs – needed to enable a large number of palm trees to produce large quantities of dates on isolated small islands located in one of the saltiest seas in the world – were abundant in these islands.

FIGURE 1 (previous page): Aerial photograph of the Muharraq Souq in 2011 showing the site after excavation and the revealed *madbasas*.

Existing conditions and protective measures

The main challenge at this site is to preserve the historic fabric, whether above ground or underground, while also reviving the retail activities of the traditional *souq*. The site is not, and never will be, considered as an archaeological site in the traditional sense as it continues to play an active part in the life of the city. Thus its presentation must be integrated with a range of activities that take place within this living heritage urban context.

As mentioned above, at some point in the 1970s the shops collapsed, burying the *madbasas* and inadvertently protecting them from weathering and human damage. However, as there was no roof, rainwater managed to infiltrate the accumulated debris and it was collected within the *madbasas*. In addition, the water table in the area has risen due to extensive land reclamation that has taken place on the island since the 1980s, to the extent that lower *madbasas* were almost at the level of the groundwater. The then Ministry of Culture (now known as the Bahrain Authority of Culture and Antiquities), decided to reveal two of the higher *madbasas* to the public and to build a shelter over each (Figure 1). Lower *madbasas* that were closer to the level of the groundwater were reburied. In designing and implementing the shelters, a number of precautions and maintenance provisions were taken into consideration to reduce the causes of decay. In addition, some interpretive panels were provided to emphasize the link between the site's history and its contemporary context.

Example shelters

The two exposed *madbasas* that were preserved *in situ* each had a shelter built over them. The first shelter was installed over an open-air exposed *madbasa* that was almost 1 m below existing ground level (Figure 2). The second was protected under a thick layer of glass at the same level as the first (Figure 3). As newly conserved and presented *madbasas*, and as the site has only been open to visitors for a relatively short time (since January 2012), no problems have been detected in their conservation and management of the visible *madbasas*. Sometimes when accumulated dust and/or garbage was cleaned from one *madbasa* the historic remains were inappropriately stepped over, however, this situation was improved through short training sessions with the workers responsible for maintenance. In addition, a very fine film of

FIGURE 2: The outdoor *madbasa* in 2012 after being revealed and presented to the public under a protective shelter. Note the interpretation panel on the back wall.







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FIGURE 3: The indoor *madbasa* in 2012 after being revealed and presented in a concealed space roofed with a clear glass. Note the circular holes used for ventilation and the smaller glass pane designed to facilitate access for maintenance.

efflorescence might have started to accumulate over the surface of the *madbasa* protected by the glass. A periodical gentle brushing away of that deposited layer was then included within the maintenance programme of the site.

The first shelter consists of a reinforced concrete slab constructed over steel columns. An existing building borders the sheltered space on the south side and a newly re constructed wall runs along the east side. Both north and west sides were left open with a handrail for visitors to view the *madbasa*. As for the second *madbasa,* it is sheltered under a thick layer of glass supported by a simple steel structure. The *madbasa* is therefore sealed in a space defined by four low walls built over the foundations of the ancient walls and a glass roof that is used as the floor of a newly functioning cafeteria so it can be walked across. The glass is set over a flexible gauge and divided into large sheets to allow maximum visibility. One of the glass pieces was made small enough to be easily dismantled to provide access when carrying out maintenance of the *madbasa*. A mechanical ventilation system was installed within the concealed space of the *madbasa* with ventilation conduits in order to maintain a climatic balance between the two sides of the glass, thus avoiding condensation and any risk of water dripping onto the *madbasa*.

No other shelters are planned for the site but there are other plans to reveal more *madbasas* that have been newly discovered in the market. There is even a project to restore one of the *madbasas* to working order so that it can produce date molasses once more. Together with interpretation panels and the archaeological remains, this would better explain this historic industry to the public, as well as providing work to some traditional molasses makers who are no longer in production.

The management context

Legal framework or mandate

The site is registered as a national monument and thus subject to Bahrain's antiquities legislation, Law 66 of 1995 for the protection of antiquities. It is privately owned and is rented out to a tenant who operates a coffee shop within the building. It is also a part of the serial site known as 'Pearling, Testimony of an Island Economy' that was inscribed on the World Heritage List in 2012 and therefore subject to the World Heritage Convention.

Institutional framework

The Bahrain Authority for Culture and Antiquities (formerly the Ministry of Culture) is the institution responsible for heritage; it has agreements with the private owner and the tenants of the site.

There is a tenancy agreement between the building's owner and its tenants and the section of this agreement that deals with maintenance was written and endorsed by the Ministry of Culture. The tenant agreed to carry out necessary daily maintenance of the exposed *madbasa* and to turn on the ventilation fans in the covered *madbasa*, and replace them when necessary. Regular monthly visits by representatives of the Bahrain Authority for Culture and Antiquities are scheduled to check on the implementation of the maintenance programme. The Bahrain Authority for Culture and Antiquities is responsible for carrying out all works on the exposed *madbasas* e.g. the removal of any deposited efflorescence, deal with any deterioration manifestation, etc.

Resources

The then Ministry of Culture provided the capital funds required to plan and install the shelter from its allocated state budget; but no further ongoing funding is allocated to the site as its management is primarily undertaken by the tenant. Financial resources are set aside by the tenant to conduct the required maintenance; the amount spent on such operations has not been calculated as it is considered part of the daily operational expenses of the business.

The Bahrain Authority for Culture and Antiquities conducts regular surveillance visits. On several occasions the authority has also provided technical advisers for the implementation of the maintenance programme and upkeep of the overall site and often, when decay is manifested on the *madbasas* themselves, it undertakes necessary conservation measures through its maintenance team.

There are at least two workers hired by the tenant to undertake daily maintenance, which includes the cleaning of the more exposed *madbasa*. The work team is managed by the tenant herself; a prominent national figure in traditional Bahraini cuisine. In her absence the coffee shop director oversees the workers as they implement the maintenance plan. There is direct contact between the tenant and the coffee shop director with Bahrain Authority for Culture and Antiquities officials for any issue related to maintenance procedures or any other unexpected circumstances and/or event, such as the need to replace the glass flooring covering the sealed *madbasa* when a sharp tool fell and cracked it.

Heritage processes

Planning for the shelters was carried out and implemented by the Ministry of Culture with written agreements signed with the site owner and the tenant. Maintenance is undertaken on a daily basis, as long as the coffee shop is open. Due to the success of the coffee shop it is rarely closed, except for some hours during the month of Ramadan. Representatives from the Bahrain Authority of Culture and Antiquities pay monthly check-up visits to the site. The design and construction of the shelters was under the technical and financial responsibility of the Ministry of Culture. Liability issues were outsourced to an external consultant, who also oversaw the issuing of permissions from the municipality.

The tenant assumes all financial and technical responsibility for the implementation of the maintenance programme and this is regularly monitored by representatives from the Bahrain Authority for Culture and Antiquities.

The current management and monitoring system is quite efficient. However, future sustainability is doubtful. The current tenant is successful in her business, so the maintenance of the heritage is carried out willingly. She is also a supporter of heritage and that is enough motivation to take the whole process forward. However, this might not always be the case for future management of the site. The rental agreement is only renewed for a year at a time and can be cancelled at any point if the owner and the tenant are not in agreement. This is a threat that needs to be addressed for the future of the site and such risk needs to be planned for.

The need to regularly check the *madbasa* enclosed under the glass cover is hindered by the long opening hours of the coffee shop, as well as difficulty in removing the glass cover for access purposes. When one of the glass sections was broken due to the impact of a sharp heavy tool (mentioned in the above example of an unexpected maintenance requirement) it was actually difficult to remove the smallest piece of the thick glass (which had been designed as an access hatch) to permit the necessary access required for the glass replacement. The operation requires specialists with special tools.

About the author

Alaa El Habashi is a professor of Architecture and Heritage Conservation at Monofia University, Egypt. As consultant to Bahrain's Authority for Culture and Antiquities he designed the protective shelters covering the *madbasas* in Muharraq.

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Jacques Neguer

Bet She'an, Israel

The site

The site of Bet She'an was a major Biblical city, located on a crossroads between the Jordan Valley and the Yizreel Valley. It later expanded into the large Hellenistic, Roman and Byzantine city of Scythopolis. This large city was levelled by a massive earthquake in the eighth century AD and remained in ruins until recent archaeological excavations began. This amazing city continues to be unearthed and reconstructed (Figure 1).

The site has been designated a national park and is managed by the Israel Nature and Parks Authority; it receives 100,000 visitors each year.

The site has 150 *in situ* mosaic floors that cover a total area of 10,000 m^2. Another 50 mosaic floors, covering more than 1,000 m^2, have been lifted in the past. Forty of the mosaics on-site have been reburied, while another seven mosaics, for a total of around 200 m^2, are under protective shelters. With the addition of the shelter over a bathhouse, this makes eight protective shelters on the site.



FIGURE 1 (previous page and right): Views of Bet She'an archaeological site within its wider setting.

Since 1921 numerous excavation campaigns at Bet She'an have revealed some 6,000 years of history. Located near the intersection of two well-travelled ancient routes, Bet She'an proved to have important strategic value as early as the fifth millennium BC, when the site was first settled. Civilizations rose and fell there throughout the Chalcolithic period and Bronze Age. Some of the most impressive finds at Bet She'an came from the Late Bronze Age, when Egyptian pharaohs controlled much of Canaan and used Bet She'an as a crucial administrative centre to rule over their vassal kingdoms. The site includes two tells (the Biblical Tel and the Tel Itztaba) and the well-preserved remains of streets, monuments, bathhouses, synagogues, churches and monasteries.

Today it plays an important part in the local economy: around 40 people are employed by the site and are involved in maintenance and conservation activities.

Existing conditions and protective measures

The conservation of the site is related to the large-scale excavations that were undertaken in the period 1990–2000. One of the project aims was to create job opportunities for a new wave of immigrants arriving in the country and the Ministry of Labour still continues to finance site maintenance activities. During this period the Ministry of Tourism has invested US$ 150 million in developing archaeological sites all over the country. However, by the year 2000 only half of the site was conserved and conservation activities continue to the present day.

There are enormous quantities of monuments and structures, mosaics and other floors, plasters and wall paintings. The main causes of their decay and deterioration are high temperatures and temperature differences, salt efflorescence and sub-efflorescence, and soil movements. In addition, the site is located in the Rift Valley where the risk of earthquakes is very high; indeed the city has been devastated by earthquakes many times in its history.







FIGURE 2 (previous page and above): Some of the *in situ* mosaics of the Sigma complex at Bet She'an.

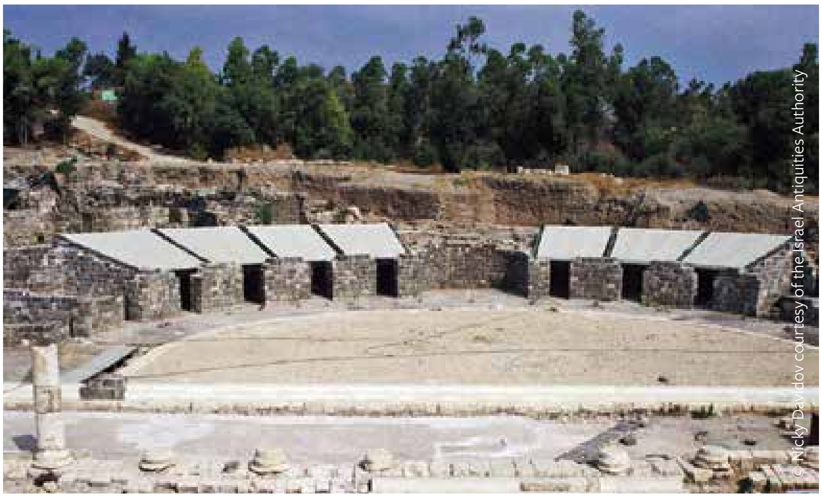


FIGURE 3: The protective shelters installed over the mosaics of the Sigma complex.



FIGURE 4: The protective shelter over the Bathhouse at Bet She'an.



FIGURE 5: Plan of the Sigma complex at Bet She'an, which was the subject of a project to install protective shelters to protect the mosaics.

The site contains eight shelters, of which seven protect the mosaics of the Sigma compound (Figures 2–3) and the eighth covers the large Western Bathhouse (Figure 4).

The site has a Monitoring and Maintenance Plan, which is updated every year and which addresses both the archaeological remains and park infrastructure. The conservation and maintenance of the archaeological remains is implemented by a team from the Israel Antiquities Authority. The maintenance of infrastructure, including protective shelters, is carried out by the Israel Nature and Parks Authority.

There is a complicated drainage system on-site that is used to protect the site from flooding during the rainy season. The amount of rainfall is relatively small but water run-off from the modern city of Beit She'an, which is located at a higher level, has badly damaged the archaeological site several times in the past.

In terms of visitation, the site is well managed with signs, walking paths and facilities for visitors. A night-time show of lights and evening visits to the site are organized during the hot summer months.



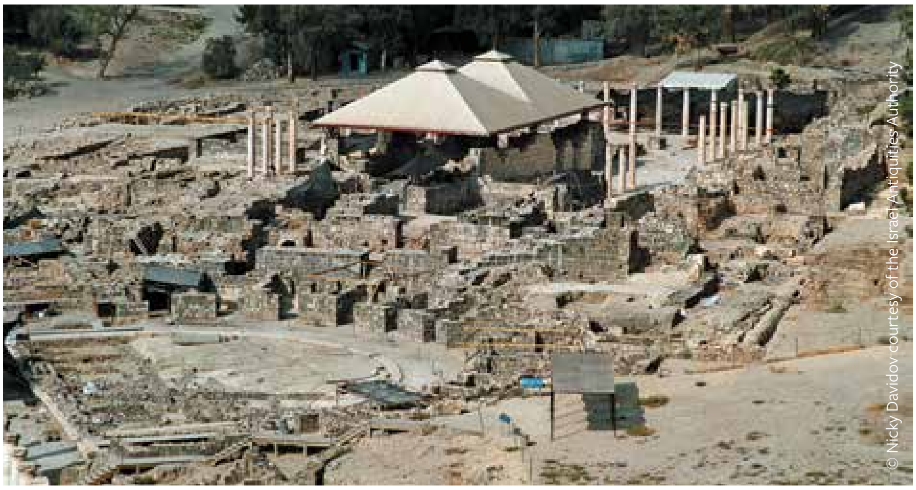


FIGURE 6: The Sigma complex at Bet She'an before the building of the protective shelters.

FIGURE 7: General views of the Sigma complex at Bet She'an with the protective shelters installed.





Example shelters

The seven existing shelters that protect mosaics were built within the scope of a single project and are identical in construction and intended to be permanent (Figures 5–7). The shelters are metal-frame structures with three and four pieces respectively of tarpaulin over a metal frame, following the shape of the archaeological spaces. The columns are anchored into reconstructed basalt-stone walls.

The structure includes gutters for draining the roof but the fabric does not cover the entire width of the walls, enabling rain to leak onto the walls and into the room below. The shelter provides protection from direct sunlight for the mosaic but fails to protect it from rain. Its design is not watertight: rain leaks down and into the walls, and damp infiltrates from the earth fill at the back of the structure. Although the average annual amount of rain is relatively low (300 mm) there is evidence of active deterioration, mainly as a result of salts.

There are no current plans for installing additional shelters on the site.

The management context

Legal framework or mandate

Israel's Antiquities Law is the primary legal framework.

Institutional framework

The primary institutional framework is the Ministry of Culture and Sport (the Israel Antiquities Authority comes under this ministry), whereas the Regional Council is the secondary institutional framework. There is also a temporary framework agreement between:

- the Israel Nature and Parks Authority and the Israel Antiquities Authority;
- the Ministry of Labour and the Israel Antiquities Authority;
- the Ministry of Labour and the Israel Nature and Parks Authority.

Resources

The annual budget for the site is NIS 3.5 million. In addition, there is a conservation and maintenance budget of a further NIS 1.25 million.

There are 24 site staff from the Israel Nature and Parks Authority, including the site manager. There are fifteen conservation staff from the Israel Antiquities Authority, including a manager.

Heritage processes

Conservation planning is based on the long-term Monitoring and Maintenance Plan and an annual condition assessment. The manager presents the plan to the Directors of the Conservation Department of the Israel Antiquities Authority and the Israel Nature and Parks Authority for approval at the beginning of every year. Each year as new site areas are conserved they are included in the maintenance cycle from the following year onwards. The conservation and maintenance processes at the site of Bet She'an are being performed in parallel until the day when everything will have been conserved and maintenance will take place across the whole site. In this way, every year the number of sites included in the long-term Monitoring and Maintenance Plan is growing and the maintenance cycle is extended accordingly.

Whereas the team of the Israel Antiquities Authority is responsible for the conservation and maintenance of the archaeological remains, the Israel Nature and Parks Authority is responsible for the maintenance of site infrastructure.

The results for this huge site are very impressive but the main problems are not resolvable within the framework of the existing management system. The project is financially dependent on the Ministry of Labour for the salaries of the local workers employed by the Israel Nature and Parks Authority and the Israel Antiquities Authority. Within the framework agreement there is no possibility of adding young local people to the staff and training them, nor of having continuity in the conservation and maintenance processes.

About the author

Jacques Neguer is an engineer and the Head of Art Conservation for the Israel Antiquities Authority, responsible for the conservation of all sites with decorative features, including Caesarea Maritima and Bet She'an. He was part of a rapid assessment of shelters over mosaics that was part of the Mosaic Research Project.

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Giovanna Patrizia Tabone and
Bruno De Nigris

Pompeii, Italy

The site

Pompeii is one of the only Roman cities to be preserved in such an exceptional way, as it was buried by a volcanic eruption in AD 79. The site offers visitors a complete picture of a Roman town in the first century AD in all its facets: urban, architectural and decorative. Pompeii was inscribed on the World Heritage List by the World Heritage Committee in 1997. The ancient town covered an area of 66 hectares (of which 44 hectares have been excavated) and was enclosed within a complete circuit of defensive walls and guard towers. Inside the walls were public buildings, temples, theatres, bath complexes, private houses and shops, with suburban villas and tombs just outside (Figure 1).

Most of the ancient buildings cannot be viewed from a distance, except for the parts of the town that can be seen from the two unexcavated areas on higher ground, the largest of which is to the northeast and then a smaller area to the south (Figure 2). Even if only some portions of the town can be seen from a distance or from above, the visual impact of reconstructed roofs and shelters must be carefully considered.

FIGURE 1 (previous page): The extent of the archaeological site of Pompeii, which is managed by the Parco Archeologico di Pompei, the local public heritage authority.



FIGURE 2: An example of a view over the archaeological site from an unexcavated – and, therefore, higher – area within Region I.



FIGURE 3: An example of a reconstructed compluviate roof in the House of Casca Longus; it has a concrete structure covered by ceramic tiles.



FIGURE 4: An example of an 'umbrella' shelter over the House of the Cryptoporticus installed as part of the *Grande Progetto Pompei*. It has a wooden structure covered with corrugated galvanized steel laminate, which is then clad in copper.

Existing conditions and protective measures

Wall paintings and mosaics are vulnerable to conservation problems caused by normal decay, which is aggravated by weather conditions (such as heavy rainfall, wind and dramatic night/day temperature variations from September to May), by hydrogeological instability and by the impact of more than three million visitors a year.

Recent analysis of the shelters for Pompeian houses identified 29 different typologies of shelter, divided into three groups: compluviate roofs (following the form of a particular Roman roof type), sloping roofs, and flat roofs. A range of materials has been used to construct these: wood, steel, ceramic tiles, corrugated plastic laminates, polycarbonate, glass, etc.

Conservation interventions have been carried out throughout the site's history, as excavation and site presentation has taken place over 250 years, and various approaches and methodologies can be seen in these three shelter categories:

- ***Philological roofing:*** where the new roof is reproduced with the same characteristics and materials as the original ancient roof. This has been done where it was believed that the available evidence supported such a reconstruction and with methodologies that respected the principles of identification and reversibility (Figure 3).
- ***Reconstruction proposal:*** where modern elements are integrated into the ancient; where some doubts remain about the original roof structure but proposing a reasonably sound reconstruction.
- ***'Umbrella' shelters:*** these simply cover a space when there is no evidence for the original ancient roof (Figure 4).





FIGURE 6: An example of a transparent shelter protecting the casts of the victims of the AD 79 eruption in the Garden of the Fugitives.

FIGURE 5: An example of a flat shelter in concrete at the Fullonica of Stephanus.

Example shelters

The continual adoption of new materials and new technologies has led to a wide range of experiments at Pompeii (Figures 5–6). The cumulative effect of this has had a visual impact that even the average visitor notices, which shows how far there is still to go towards finding a satisfactory solution to this issue (Figures 7–8).

Some past solutions now conflict with conservation aims. For example, the effectiveness of the brick/cement roofs or the efficiency of asbestos were widely accepted until recently, yet have proved totally ineffective and have had disastrous consequences. It has now become necessary to resolve the increasing damage as the problems themselves become increasingly difficult to manage. Issues that need tackling include the decay of heavy reinforced concrete structures, which need replacing with wooden structures, and this poses a number of questions related to their compatibility with the ancient masonry structures. There are also problems related to plastic materials, such as polycarbonates, which have unresolved issues related to climate and light.

The only issue that is clearly agreed upon is that any protective system requires constant monitoring and maintenance of an efficient water drainage system, where the water is then removed from the archaeological area. This is essential for reducing the causes of decay processes and guaranteeing better conservation in the long term.

Many new shelters are being planned at the time of writing in the context of huge efforts underway within a project known as the *Grande Progetto Pompei*. Since 2012 this site-wide project has aimed to restore stable conservation conditions across the site, thanks to €105 million of European and national funding through the European Regional Development Fund for the periods 2007–13 and 2015–20.

The management context

Legal framework or mandate

The protection of the landscape and artistic and historic heritage is one of the responsibilities of the Italian State, as set out in Article 9 of the Constitution, which came into effect in 1948 and states: ‘The Republic promotes the development of culture and of scientific and

technical research. It safeguards natural landscape and the historical and artistic heritage of the Nation' (Senato della Repubblica 1947). Italian legislation has been applied to aspects of the protection and conservation of cultural heritage since the nineteenth century, both before and following the unification of Italy, and over the last century this has led to a number of regulatory cornerstones such as: Law 1089 of 1939 regarding the protection of items of artistic and historic interest (*Tutela delle cose d'interesse artistico e storico*); the 1999 consolidation of legislation relating to cultural and environmental assets (*Testo unico delle disposizioni legislative in materia di beni culturali e ambientali*); and the law concerning cultural heritage and the landscape (*Codice dei Beni Culturali e del Paesaggio*), in force since 2004 with a number of subsequent additions and modifications.

Institutional framework

Up until 1974 the constitutional mandate fell within the remit of the Ministry of Education, followed by the Ministry for Cultural Heritage and Activities and for Tourism. The ministry is organised into directorate generals (a series of central offices for general management), under which are regional secretariats and the local superintendencies for the management of heritage. These are distributed throughout the country and manage the cultural heritage under their territorial jurisdiction, with direct responsibility for protection, conservation, enhancement and use.

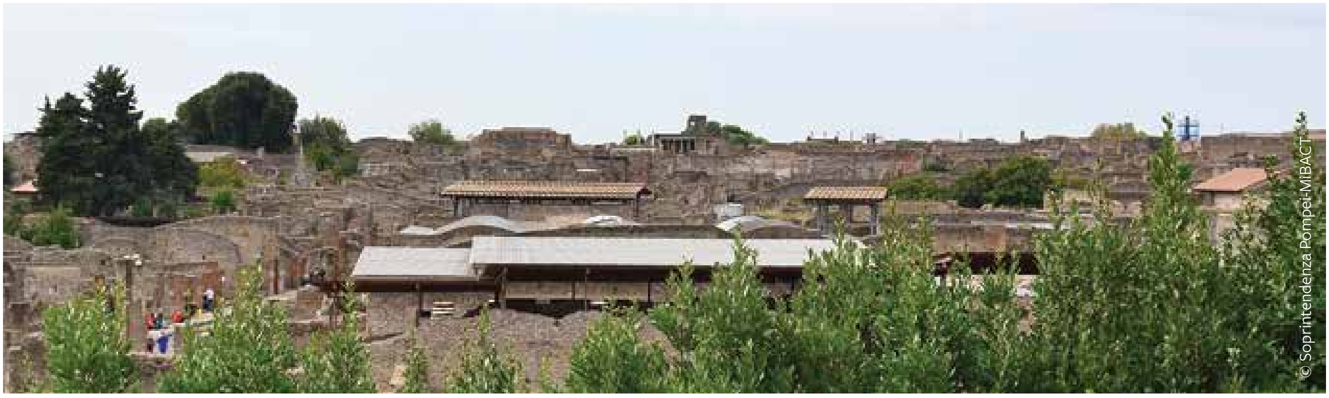
Given the uniqueness of the site of Pompeii and its exceptional cultural values that led to its inscription – together with Herculaneum and Oplontis – on the World Heritage List in 1997,



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FIGURE 7: The view over Region I near the Via dell'Abbondanza, where different types of protective shelters can be seen over the Roman houses.

FIGURE 8: The view over Region VII near the Via dell'Abbondanza with the shelters over the Stabian Baths in the foreground.



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the superintendency of Pompeii has had a different status from other superintendencies since then. It was given management autonomy in terms of the direct management of its own budget, which includes all income from ticket sales, with oversight from an administrative board.

Resources

Financial resources for Pompeii's institutional activities come from a number of sources: income from ticket sales brings more than €30 million a year; annual funding from the ministry budget, which varies in amount; and funds procured for five-yearly projects that attract a mixture of funding at European and national level (an example is the *Grande Progetto Pompei* mentioned above).

Human resources are allocated by the ministry. At the sites under the jurisdiction of the Parco Archeologico di Pompei (including Oplontis, Boscoreale and Stabiae) there are the following staff categories: site wardens; technicians; administrators and administrative assistants; IT specialists; architects; and archaeologists.

Heritage processes

Planning of conservation and/or enhancement actions is carried out within Triennial Programmes, which are updated on an annual basis. Project management is normally outsourced to external contractors but in the case of the *Grande Progetto Pompei,* which aims to ensure the safety of the archaeological area of Pompeii, the project has been managed internally, with additional professional support provided by the Ministry for Cultural Heritage and Activities and for Tourism, with the support of other ministries (such as the Ministry for Economic Development). When there is special funding, as in the case of the *Grande Progetto Pompei*, the additional activities follow a programme structure in accordance with the funding regulations.

About the authors

Giovanna Patrizia Tabone, archaeologist, and Bruno De Nigris, architect, both work for the Soprintendenza Speciale Pompei, the heritage authority that manages the archaeological site of Pompeii. As public officers they are each responsible for monitoring the conservation needs of specific areas of the site.

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Samar Karam

Tell Arqa, Lebanon



The site

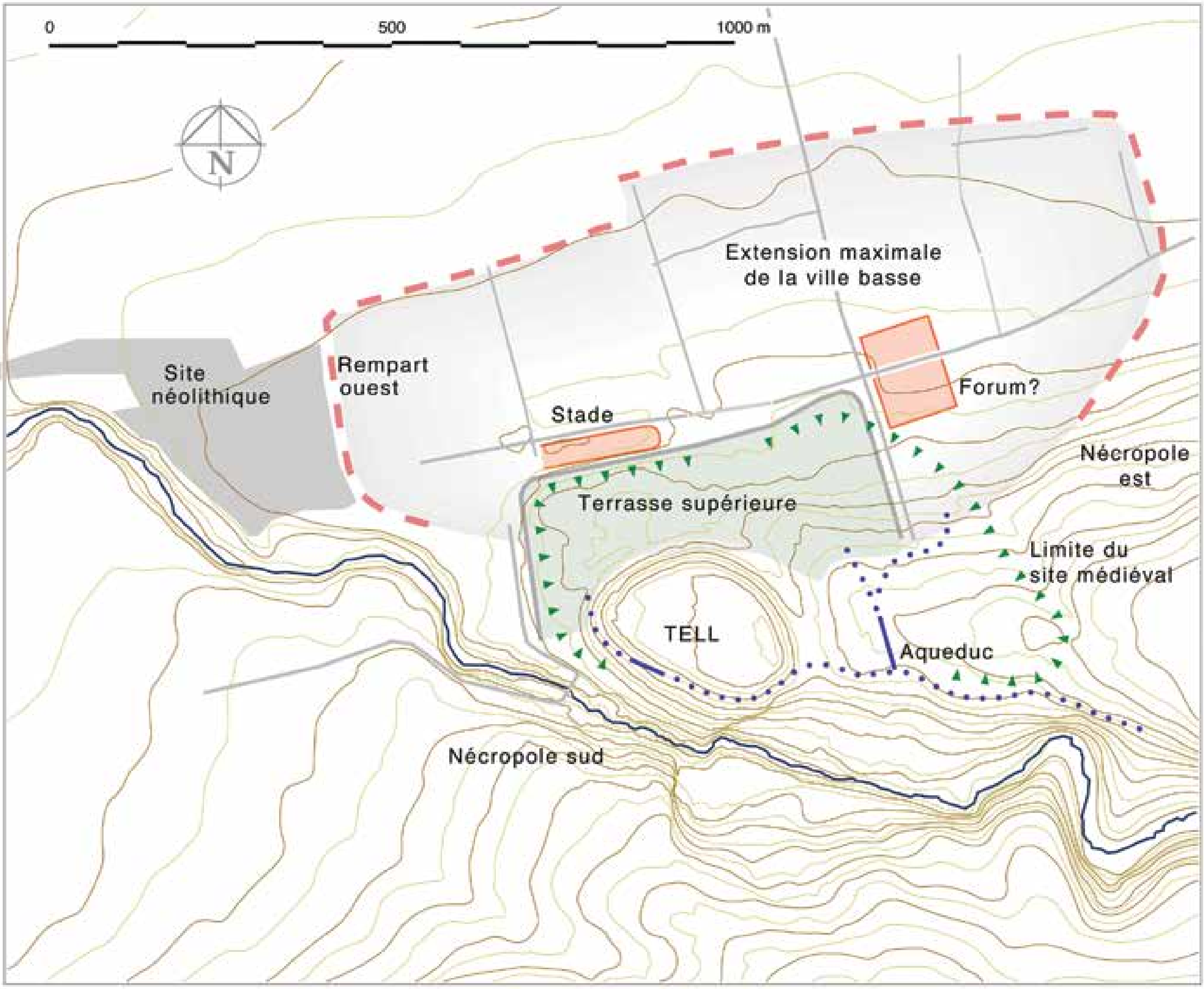
Tell Arqa is the most significant archaeological site in northern Lebanon. Today it is located in Arqa, a village near the coast in the Akkar district, 100 km north of the capital Beirut (Figure 1). The site dates back to Neolithic times and saw continuous occupation up to the medieval period. The entire history of the country can be read in about 30 m of stratigraphic accumulation. The ancient town of Arqa played an important role in the area's history and its name appears many times in the Bible, in Egyptian texts of the second millennium BC and in Assyrian texts of the first millennium BC.

The Tell Arqa Archaeological Site belongs to the Ministry of Culture and its management is the responsibility of the Directorate General of Antiquities of Lebanon (Figure 2). Excavations have been carried out there by a French archaeological mission since 1972. Between 1992 and 2015 the excavations of the French mission, under the direction of Jean-Paul Thalmann, have mainly focused on the Early and Middle Bronze Age levels (3000–1500 BC), one of the main periods of prosperity and development of both the site and the wider region. The oldest artefacts found in the surrounding plain seem to date back to the Natufian and Pre-Pottery Neolithic periods. The excavations have revealed a flint workshop and the presence of obsidian is evidence for commercial exchanges during the Neolithic and Chalcolithic periods.

The site continued to evolve until the end of the third millennium BC. During the Bronze Age Arqa was a city-state, which meant it had relative independence in governing the surrounding area. There are remains of houses on two floors and many rooms, ramparts and tombs. The inhabited area in the Bronze Age IV period (2400–2000 BC), which was destroyed by fire in about 2200 BC, has delivered exceptionally detailed information on the domestic architecture of that period. Houses built to more than 3 m in height and grouped in dense clusters were built in mud brick on stone foundations but they also included internal partitions and wooden floors (Figure 3).

FIGURE 1 (previous page): General view of Tell Arqa within the landscape.

The Middle Bronze Age period is best represented by a potter's workshop, various silos, and a necropolis that was occupied for nearly half a millennium. By the Late Bronze Age the site seems to have lost importance at a regional level and the city was destroyed by Thutmosis III in 1450 BC. The site was deserted during the Early Iron Age and then reoccupied in the Iron II phase, as can be seen from the sanctuary of that period.



During the Roman period Arqa was called Caesarea of Lebanon and the Roman emperor Alexander Severus (AD 222–235) was born there. The city extended beyond its circuit walls; the lower town that extended onto the plains and the Roman stadium date to this period.

FIGURE 2: A plan of the archaeological area showing the main features of the site around the tell.

In 1108 the Crusaders took control of the strategic castle of Arqa from the Banu Ammar but the Mamluke Sultan Baibars captured it in 1266 and left various monuments, such as defensive walls and a cistern.

Tell Arqa is a very important site because of its continuous occupation and the quality of its remains. Excavation has revealed mud-brick walls surviving to significant heights and has shed light on the architecture of these brick houses. The site presents a complete historical sequence.

Existing conditions and protective measures

Mud-brick structures are one of the most fragile types of construction, requiring ongoing maintenance and adequate conservation. For this reason a seasonal shelter is essential to protect the site from the effects of bad weather. Rain, wind and storms are the main problems; annual consolidation and cleaning works are necessary to maintain the integrity of the site (Figure 4).



FIGURE 3: The Bronze Age domestic structures during excavation; these mud-brick structures are fragile and require ongoing maintenance and adequate conservation.



FIGURE 4: Consolidation works take place each year on-site and, together with the use of protective shelters, are the key method employed to maintain the site's integrity.

FIGURE 5: The current protective shelters are built on-site each winter using corrugated iron on a timber frame.





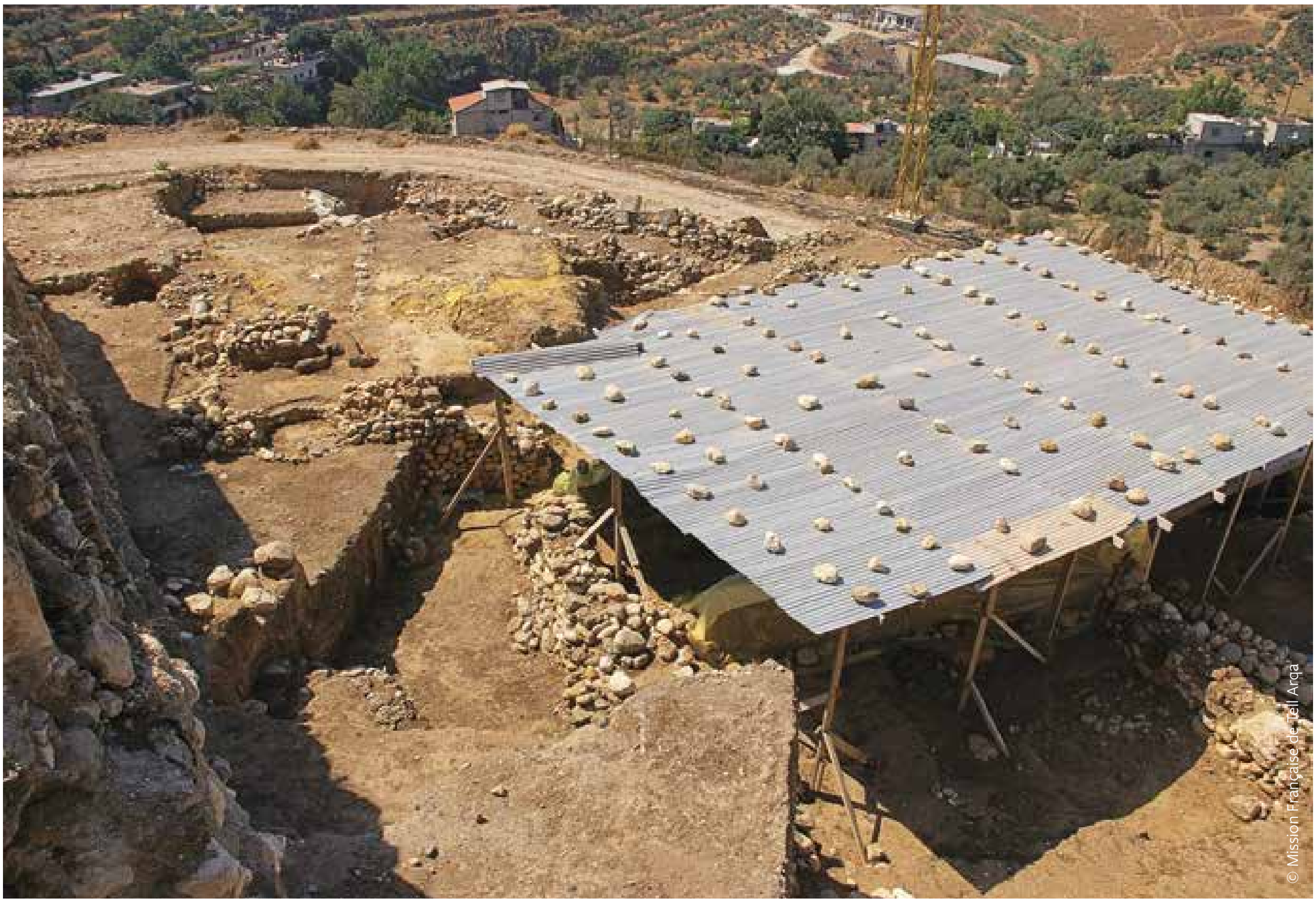


FIGURE 6: The seasonal protective shelter covers a large mud-brick structure and is built each year by a local workforce.

Example shelter

In the winter season the site is covered by a shelter to preserve the mud-brick construction over an area of 1,500 m^2. The current seasonal shelter is in corrugated iron resting on wooden beams placed between the archaeological structures. It is often damaged in winter when it is used; the shelter itself is made by the local workforce and every year any damaged boards are replaced (Figures 5–6).

The site is not frequently visited because of its geographical location and due to the complexity of the remains, which are not easy to understand and interpret without assistance. This complex archaeology and the monumental structures, limited resources and a lack of professional staff mean that a project for site development and presentation is very much needed. Initiatives based on culture and tourism are needed to help visitors to understand the site and plans for this include:

- Construction of a site museum: built at the foot of the tell, the structure will be inspired by the vernacular architecture of the area. There will be two major exhibition areas, the first space will display the site's 7,000 years of history (using maps, models, etc.), while the second space will display artefacts (ceramics, small finds, etc.).
- Creation of a visitor route through the Bronze Age area of the site: in order to make the walkway easier to navigate and to facilitate interpretation of the route, this group of urban houses will be covered by a shelter. The Burnt Adobe House and the Medieval Cistern may also be restored and reconstructed.
- Renovation of the site house and finds storerooms.

The management context

Legal framework or mandate

The site is protected by the Lebanese National Law 166 on Antiquities of 1933.

The site extends over an area of ten hectares, of which about only two hectares have been excavated so far. A buffer zone has been defined, which is a large area of expropriated land or land that is destined to be expropriated. There is a second level of protection provided by the Directorate General of Urban Planning so that no new building can take place in this area and it is categorized as an agricultural area.

Institutional framework

Tell Arqa is the property of the Directorate General of Antiquities, which has responsibility for its management.

The French archaeological mission has a mandate from the Directorate General of Antiquities, under the terms of a *cahier des charges*, to carry out excavations, consolidation and restoration activities.

Resources

A limited annual budget for consolidation and preservation of the archaeological site comes from the Lebanese heritage authority. The budget of the French scientific mission is largely allocated to excavation and some restoration work.

Tell Arqa comes under the responsibility of the Directorate General of Antiquities archaeologist who is assigned the management of the archaeology in northern Lebanon: lately this role has been assisted by a second archaeologist. Three guards are permanently present on site.

Decisions related to conservation issues are taken in collaboration with the French mission in order to coordinate actions on site.

Heritage processes

The Directorate General of Antiquities is responsible for the management of the Tell Arqa Archaeological Site and its annual budget guarantees the basic management actions for a site with ongoing excavations. The French mission is also responsible for consolidation and restoration works according to the terms of the *cahier des charges*. Planning is a process that depends on the progress of excavation and, of course, on the state of conservation of the structures; decisions are taken together with the French mission.

The presentation of the Bronze Age sector of the site to the public requires various specialists and, most importantly, an allocated budget.

About the author

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Jean Yasmine



Tyre El Bass, Lebanon

The site

The archaeological site of Tyre is located in South Lebanon. The Directorate General of Antiquities is responsible for the management of all archaeological sites throughout the country; however, the Lebanese government has assigned responsibility for the implementation of conservation projects within the archaeological site of Tyre to the Council for Development and Reconstruction, a governmental institution responsible for the delivery of large projects in Lebanon. This site is a World Heritage property inscribed under criterion (iii) because Tyre was a metropolis and hub for major land and maritime commerce, and criterion (vi) as Tyre is associated with important stages in human history.

FIGURE 1: Aerial view of the Tyre El Bass site



The Tyre El Bass site would have been the main entrance to the ancient city (Figure 2). The archaeological area includes the remains of a necropolis on either side of a wide monumental causeway dominated by a Roman triumphal arch dating to the second century AD (Figure 1). Other remains include an aqueduct and the hippodrome of the second century, one of the largest in the Roman world. The archaeological remains at the El Bass site are characterized by the presence of numerous tomb complexes of various typologies, small chapels and gardens, all located around what remains of the aqueduct pillars. One of the most significant monuments in the necropolis is the Monumental Tomb.

The El Bass site is more than 900 m in length and includes more than 40 tomb complexes, *columbaria* and other

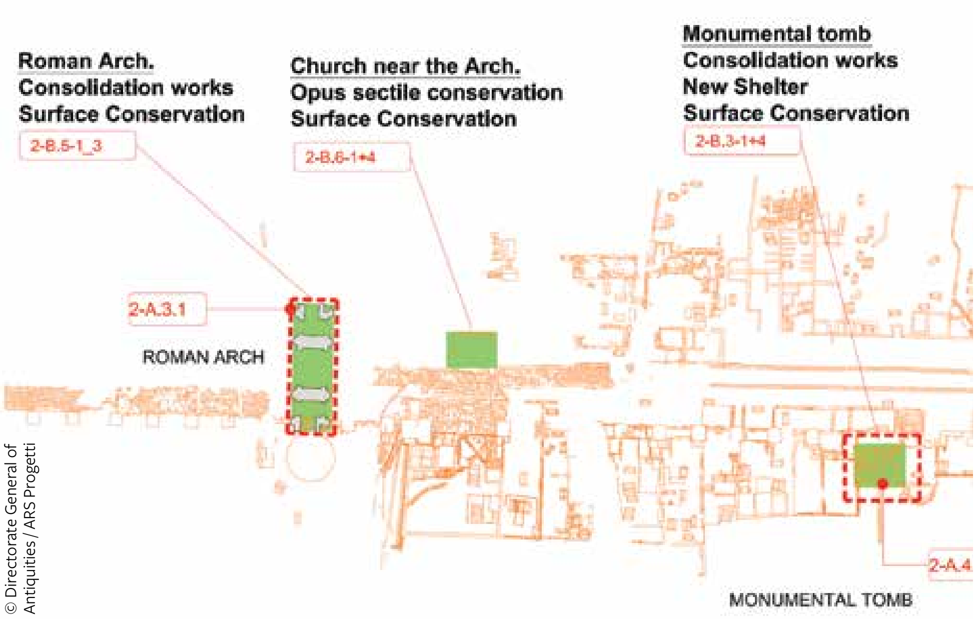


FIGURE 2: General plan of the Tyre El Bass site.



FIGURE 3: Plan of the Monumental Tomb and its context.



FIGURE 4: The Monumental Tomb in 2005 before construction of the protective shelter.

funerary structures. The Monumental Tomb (Complex 9), which is located 105 m to the east of the Roman monumental arch, measures almost 15 x 15 m and covers an area of 10 x 10 m. It is built on two storeys and includes very important remains dating from the first to the sixth centuries AD (Figure 3).

The local community and visitors have a lateral view of the tomb, as it is located next to the visitor route leading to the Roman arch (Figure 4).

Existing conditions and protective measures

The main conservation problems at the site are due to a lack of maintenance, owing to a shortage of human resources dedicated to site management. More specifically, the Monumental Tomb suffers from structural conservation problems (out-of-plumb walls) and surface conservation problems. Both of these issues are caused by rainwater penetration.

No shelters have ever been constructed on-site to protect the archaeological remains. A conservation project for the Monumental Tomb aims to consolidate its walls, ensure a treatment of those surfaces exposed to climatic conditions and avoid water penetration from above by constructing a shelter. This project is implemented within the framework of the Baalbek and Tyre Archaeological Project, which is a conservation project that comes within the larger Cultural Heritage and Urban Development Project. The Baalbek and Tyre Archaeological Project includes structural and surface conservation measures in addition to visitor infrastructure development and improvement of site management and presentation.

Example shelter

At the time of writing there are no existing shelters at the site.

A proposed new shelter for the Monumental Tomb is a pilot project, as no comparable initiative has yet been implemented in Lebanon. The various funerary complexes at the site of Tyre El Bass suffer from similar conservation problems essentially caused by rainwater penetration. The design planning process has been carried out with the participation of a multidisciplinary team (archaeologists, conservators, structural engineers, architects, etc.), the staff of the Directorate General of Antiquities and the site manager. The new shelter has been designed to have a light durable structure (steel columns and wooden beams with zinc roofing) that can be easily removed (Figure 5). It ensures effective drainage of rainwater while keeping the atmosphere, temperature and humidity inside the tomb similar to conditions outside. The proposed shelter will inevitably have an effect on the view one has of the whole archaeological site. Indeed, multiple shelters spread over the various funerary complexes would create a very negative impact on the visitor's perception of the site. This pilot project therefore aims to mitigate the negative visual impact of the new shelter by taking into consideration appropriate size, materials, form, etc., as well as its archaeological context.

The management context

Legal framework or mandate

The site is classified as a national archaeological site. It is therefore protected under the Lebanese Law of Antiquities (1933), placing the site under the responsibility of Lebanon's Ministry of Culture.

The site lies within the limits of the Tyre World Heritage property (Tyre is No. 299 on the World Heritage List) and therefore the conditions of the World Heritage Convention have to be respected.

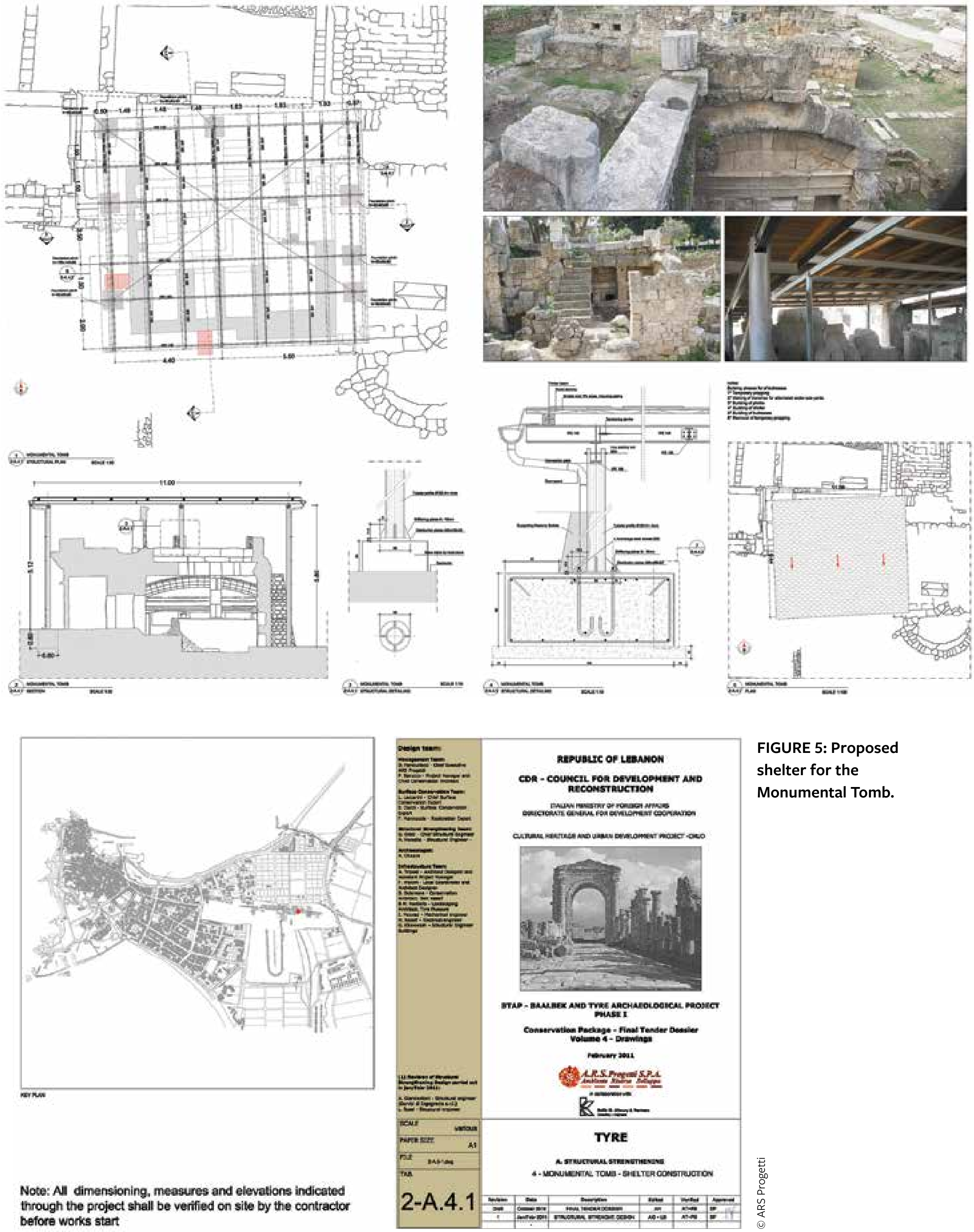


FIGURE 5: Proposed shelter for the Monumental Tomb.



FIGURE 6: The Monumental Tomb after the installation of the shelter in 2015.

Institutional framework

The Directorate General of Antiquities, which comes under the Ministry of Culture, is responsible for site management.

The Tyre municipality helps the Directorate General of Antiquities from time to time in maintaining the site, through cleaning and weeding activities.

The Council for Development and Reconstruction has been assigned by the Lebanese government the task of executing the Cultural Heritage and Urban Development Project, within the framework of which sits the Baalbek and Tyre Archaeological Project, in order to improve site conservation, management and presentation. The mandate of the Council for Development and Reconstruction is temporary, since after a project is completed it is handed back over to the Directorate General of Antiquities.

Resources

Financial resources: very few resources are available for conservation and site management. The global yearly budget for the site cleaning and weeding does not exceed US$ 30,000. Very small budgets allocated for conservation are episodic and are always provided when an urgent conservation problem emerges that the Directorate General of Antiquities has to address.

Human resources: two archaeologists are in charge of the Tyre region. One is the manager who is responsible for the site and for the whole region of Tyre. The second archaeologist is responsible for administrative duties. The only permanent staff of the Directorate General of Antiquities are ten guards. All other services are outsourced (e.g. external consultants, contractors, suppliers, etc.). The annual budget dedicated for salaries is around US$ 120,000 (this does not include outsourced services).

Heritage processes

Planning is carried out randomly. The shortage of human resources dedicated to the site and within the central administration does not allow regular planning processes. On many occasions, in particular within the Cultural Heritage and Urban Development Project, external consultants were requested to help the Directorate General of Antiquities in the planning process. This took place in 2002 at the time when the Baalbek and Tyre Archaeological Project was drafted. The project was then designed and ready for implementation in 2008.

The Directorate General of Antiquities has undertaken a very complex inventory-based management system. An archaeological geographic information system (GIS) was prepared within the framework of the Cultural Heritage and Urban Development Project (known as Tyre Archaeological Mapping). The Directorate General of Antiquities updates this GIS with all relevant archaeological data in a continuous manner. This GIS is used by the Directorate General of Antiquities as a planning tool within the World Heritage property boundaries.

For project implementation, the Directorate General of Antiquities is responsible for all scientific activities, although it should be noted that foreign archaeological missions also work at the site. For modest conservation activities funded by small donors, the Directorate General of Antiquities carries out the works. For bigger projects funded by the government, the Council for Development and Reconstruction implements works through qualified contractors under the supervision of archaeological heritage consultants. The Directorate General of Antiquities follows up this implementation through its regular staff.

The current management system has a major problem: its sustainability. Once works are executed and the project results handed over to the Directorate General of Antiquities, the limited human and financial resources available affect its sustainability over time. Although the capital provided for works carried out by the Council for Development and Reconstruction may be substantial (with large budgets of some US$ 5 million) it does not provide any funding for ongoing monitoring or maintenance of these interventions beyond the project. This absence of longer-term investment is one of the main threats affecting site management, presenting significant challenges in addressing issues of conservation and safety over time.

Finally, because of the need to implement the 1972 World Heritage Convention during works (since the site is listed as a World Heritage property), the Directorate General of Antiquities and the Council for Development and Reconstruction appointed international conservation experts to monitor the procedures, approaches, actions and end results. At the time of writing, a reporting procedure involving all the relevant parties (the Council for Development and Reconstruction, the Directorate General of Antiquities, ICOMOS and the UNESCO World Heritage Centre) has taken place; two workshops have been organized by UNESCO's Beirut Office with the participation of the Directorate General of Antiquities and the Council for Development and Reconstruction.

Postscript

The proposed shelter mentioned above was installed in 2015 after structural strengthening measures were partially completed (Figure 6). As already stated with regard to the project design phase, this shelter has been used as a pilot project. Discussion during the Symposium on Protective Shelters for Archaeological Sites at Herculaneum had stressed the importance of taking into consideration the specific climatic conditions of the site before and after

erecting shelters. Temperature and humidity loggers were therefore installed under the shelter and provided additional data on the site environment. It was clear that the shelter created a microclimate with particular humidity levels because of the high level of the water table in springtime. It was recommended, during workshops organized by UNESCO, to avoid surface conservation works and to continue with very accurate monitoring of the microclimate under the shelter. In parallel, the conservation status of the monument's elevations continues to be monitored in order to assess the suitability of such shelters at the Tyre El Bass site.

About the author

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Adel El-Turki

Villa Silin (Leptis Magna), Libya



The site

Villa Silin is an ancient Roman residence overlooking the sea that is renowned not only for its immense size (44 rooms over approximately 2,600 m^2), but also for the magnificence of its mosaics and painted decorations (Figure 1). It belongs to a well-known category of seafront villas planned on a grandiose scale that dotted the Libyan coastline in ancient times. Such villas were found in denser clusters in proximity to the larger towns throughout the region and were especially common along the coast near the ancient city of Leptis Magna. This type of villa enjoyed splendid seafront locations with extensive gardens and was favoured by wealthy urban Roman landowners. Various rooms in the villa were decorated with unique floor mosaics, many of which show human figures and are bordered with intricate patterns. Most of the walls had frescoes depicting social and pastoral scenes. The walls of the bath complex were clad in marble (Figure 2). At the time of writing, the villa is undergoing restoration so public access is very limited. The only shelter that currently exists is a corrugated brick and asbestos cement roof (Figure 3).

Existing conditions and protective measures

The main conservation problems at the site are caused by the surrounding marine environment: salinity, humidity and biodeterioration phenomena all affect Villa Silin.

Evidence of water leaking from the roof is found on the mosaic flooring and can be linked to the deterioration of the mosaics, mural paintings and the plaster renders (Figure 4); the conservation conditions of the monument have been badly affected. There is an absence of visitor information, signage and detailed descriptions of the archaeological remains at the villa.

Example shelter

FIGURE 1 (previous page): Aerial view of the Roman-period Villa Silin.

The shelter that currently exists, and which roofs the villa building, is made up of corrugated brick and asbestos cement. It leaks and is made of materials that can present health hazards. In addition to this, there are also problems related to its drainage system.

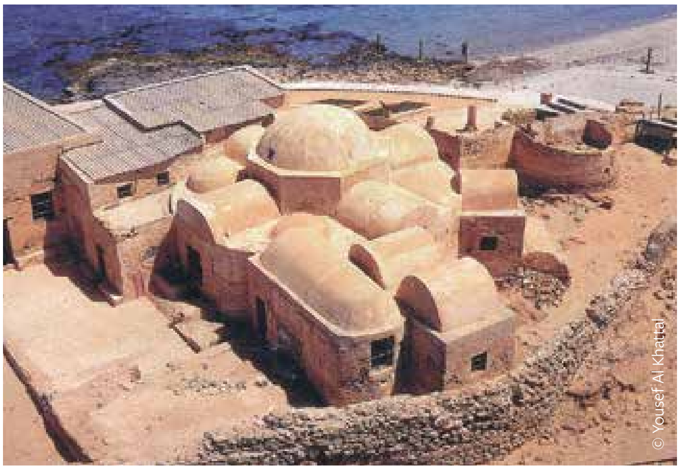




FIGURE 2 (above left): Aerial view of the eastern sector (bath complex) of the Villa Silin.

FIGURE 3 (above right): The existing corrugated brick and asbestos cement shelter.

FIGURE 4: The east esplanade with mosaic floor.



A replacement shelter has been proposed that foresees the installation of a tensile membrane roof and steel cable structure with supports placed outside the perimeter of the archaeological remains (Figures 5–6). The details of this proposal are being studied at the time of writing.

The management context

Legal framework or mandate

Sites in Libya are protected by the national constitution. Law 40/1968 governs the administration of antiquities, including the protection of monuments and sites.

Local by-laws dated to 11/1953, under this law of protection for archaeological sites, are recognized by the Libyan Department of Antiquities. The villa is not included within World Heritage property (the Archaeological Site of Leptis Magna was inscribed on the World Heritage List in 1982) but its management falls under the law stated above.

Institutional framework

The Ministry of Culture is ultimately responsible for heritage in Libya and it works through its Department of Antiquities. At a local level there is a superintendency for Leptis Magna, which has responsibility for managing Villa Silin. There is a framework agreement signed between the Department of Antiquities and archaeological missions covering issues such as survey, excavation, documentation, publications, etc.

Only a limited budget is available from the Department of Antiquities for the site's management, which covers all projects within the territory of the Leptis Magna site and surrounding

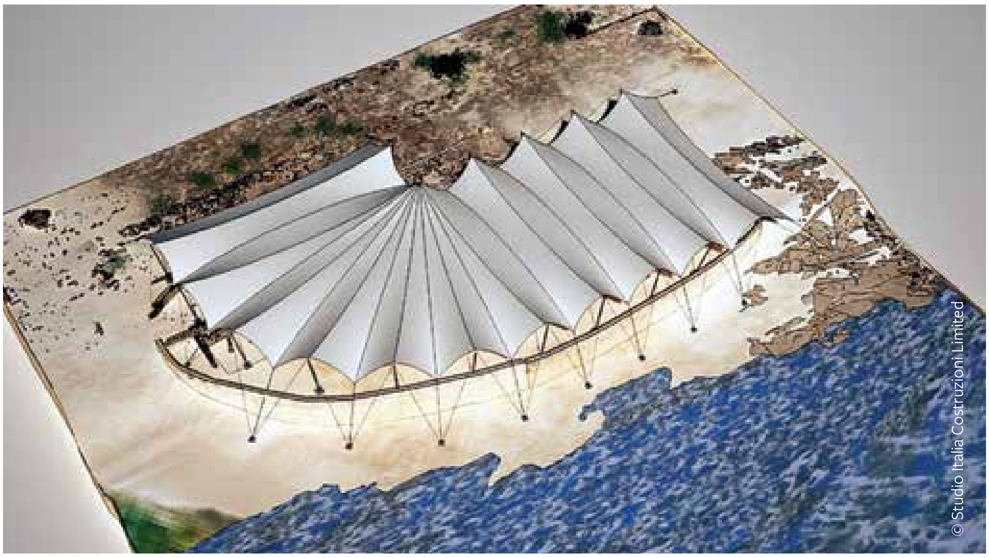


FIGURE 5: Aerial view of the design proposal for a membrane shelter to cover the entire villa.

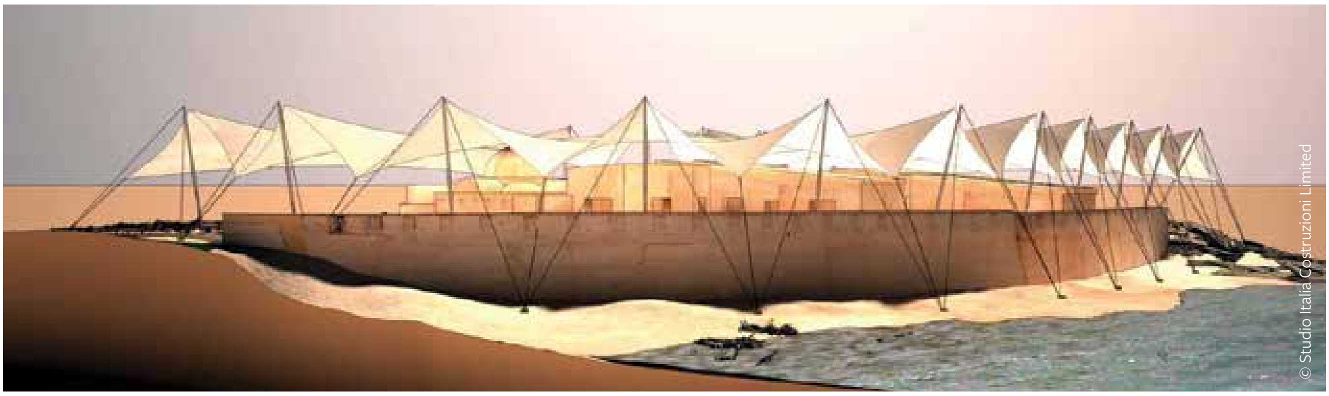


FIGURE 6: Side view of design proposal for membrane shelter.

archaeological sites. In addition to this global budget some additional funding is made available by foreign archaeological missions.

The site is managed directly via the Leptis Magna site manager who works under the Department of Antiquities. Other human resources are the five conservators and three keepers.

Heritage processes

Planning for the 'first-aid' conservation work at the Villa Silin started in 2011. Unfortunately, local management and the conservation plans are very poor due to a lack of specialist training in conservation and restoration.

A report for each site activity carried out by the foreign missions is delivered to the site manager via the head of those foreign missions.

About the author

Adel El-Turki is a materials scientist specialising in conservation. Between 2010–14 he was Head of Conservation and Restoration within Libya's Department of Antiquities. Since then he has been based at the Interface Analysis Centre at the University of Bristol, UK.

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Abdelkader Chergui

Chellah, Morocco

The site

The site of Chellah is located in the middle of Rabat, the capital of the Kingdom of Morocco; on the left bank of the Bou Regreg river, about 2 km away from the city centre. The site has been placed under the supervision of Morocco's Ministry of Culture and is directly managed by Chellah Conservation, an administrative department supervised by the Directorate of Cultural Heritage.

The archaeological site of Chellah is richly endowed in terms of its tangible and intangible cultural patrimony, and its rich, varied and wide-ranging natural heritage. It reflects a number of values:

- Archaeological heritage – the Mauretanian and Roman remains of ancient Sala Colonia.
- Built heritage – of particular note are the monuments of the Marinid-era necropolis, dating back to the fourteenth century AD.
- Intangible heritage – related to legends associated with ritual practices organized around the eel pool, *marabouts* and the *mihrab* of the *madrasa*.
- Natural heritage:
  - the Andalusian Gardens, a verdant enclosed area with various species of trees and flowers;
  - an area of farming plots abutting the perimeter of the site;
  - the vast natural landscape of the Bou Regreg Valley;
  - a colony of storks (more than 200 nests) living within the site boundary.
- The site represents the city of Rabat's initial urban core.
- The site is Rabat's most important tourist destination.

FIGURE 1 (previous page): A view across the archaeological remains at Chellah, showing its fairly untouched location in the landscape.

As for the topography of the site, it follows the curve of a 67-m-high rock spur, overlooking the flood plain of Oulja within the Bou Regreg Valley. The intramural area extends over seven hectares, with the area outside the walls covering another sixteen hectares.

Urban planning has adapted to the natural slope of the terrain since antiquity, as can be seen in the terraces built to accommodate construction.



FIGURE 2: The *madrasa,* which is associated with Chellah's intangible heritage and ritual practices still take place there.

Existing conditions and protective measures

There are currently no protective shelters on the site. There is a shortage of skilled workers/technicians needed to carry out conservation activities. The budget dedicated to maintenance is still limited.

The management context

Legal framework or mandate

- Constitution of Morocco
- Current Moroccan legislation:
  - Law 22-80 on the conservation of historic monuments and sites, inscriptions, art objects and antiques (1980) subsequently modified by Law 19-05 (2006)
  - *Dahir* (royal decree) of 19 November 1920 with regard to the Chellah ruins (*Bulletin Officiel* 423, 23 November 1920: 2016)
  - Vizirial Order of 5 August 1932 declaring the development of the site of Chellah to be urgent and of public interest and expropriating the necessary plots of land (*Bulletin Officiel* 1035, 26 August 1932: 990)
  - Decree regarding the site of the mouth of the Bou Regreg river in Rabat (*Bulletin Officiel* 2154, 15 February 1954: 179)
- World Heritage obligations as part of the World Heritage property of 'Rabat, Modern Capital and Historic City: a Shared Heritage' (inscribed in 2012)

Institutional framework

- Ministry of Culture
- Directorate of Cultural Heritage

- Regional Directorate of Culture (of the former region of Rabat-Salé-Zemmour-Zaër)
- Chellah Conservation, a department for the archaeological site of Chellah and of the site of Oudaïa

Resources

Financial resources:

- Operating budget of the Directorate of Cultural Heritage for 2011: 275,850.00 DHM
- Operating budget of the Directorate of Cultural Heritage for 2012: 217,000.00 DHM
- Welcome, safety, surveillance and security services for the sites of Chellah and Oudaïa: 1,248,212.40 DHM
- Landscape maintenance services in Chellah and Oudaïa: 1,494,240.00 DHM

Human resources:

- Chellah Conservation, the department for the sites of Chellah and Oudaïa includes fifteen permanent public officers:
    - one chief curator
    - two associate curators
    - one technician (follows up works on the site)
    - seven works staff
    - four collectors for the National Fund for Cultural Activities
- As part of the outsourced management the site of Chellah has fifteen gardeners (both skilled gardeners and general workers) and seventeen day and night security guards.

Heritage processes

Planning for the site is done internally by Chellah site staff and the Technical Division of the Directorate of Cultural Heritage. The goals to be achieved are defined by agreement and actions for the next three to four years are agreed on a priority basis. The Directorate of Cultural Heritage requests studies on specific issues relating to the site, which are carried out by various agencies. As a result of the decision to list the site as part of a World Heritage property, a management plan was drawn up for 2011–16, which includes a number of defined actions and multiple public partners.

The implementation of projects is sometimes directly undertaken by institutions from within the ministry, for example the restoration of the Marinid enclosure, which is currently being undertaken in partnership with the Inspectorate of Historic Monuments. On occasion private contractors are procured through a public tender process. Supervision of works, services provided and liability is the responsibility of the public administration (specifically, Chellah Conservation and the Directorate of Cultural Heritage).

The management system that is in place to carry out the measures necessary to achieve conservation goals remains reliable. However, this system is continually dependent on public funding and, given the current economic crisis, is unable to meet the ever-increasing requirements for conservation interventions.

About the author

Abdelkader Chergui works for the Direction du Patrimoine Culturel of Morocco's Ministry of Culture. He has been the conservator for the archaeological sites of Chellah and Oudaïa since 2010.

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Mustapha Atki

Volubilis, Morocco

The site

The site of Volubilis is situated 26 km north of the town of Meknes in Morocco (Figure 1). It is under the responsibility of the Ministry of Culture.

Volubilis is one of the richest sites from the Roman period in North Africa. It has a history spanning thirteen centuries, during which there was a succession of civilizations from the Mauretanian period to the Islamic period, passing through the Roman and early Christian eras (Figure 2).

The wealth of its history, the preservation of these remains and the uniqueness of its cultural landscape led UNESCO to inscribe Volubilis on the World Heritage List on 12 June 1997 on the basis of four criteria:

Criterion (ii): The archaeological site of Volubilis is an outstanding example of a town bearing witness to an exchange of influences since High Antiquity until Islamic times. These interchanges took place in a town environment corresponding to the boundary of the site, and in a rural area extending between the prerif ridges from Zerhoun and the Gharb Plain. These influences testify to Mediterranean, Libyan and Moor, Punic, Roman and Arab-Islamic cultures as well as African and Christian cultures. They are evident in the urban evolution of the town, the construction styles and architectural decorations and landscape creation.

Criterion (iii): This site is an outstanding example of an archaeological and architectural complex and of a cultural landscape bearing witness to many cultures (Libyco-Berber and Mauritanian, Roman, Christian and Arabo-Islamic) of which several have disappeared.

Criterion (iv): The archaeological site of Volubilis is an outstanding example of a focus for the different kinds of immigration, cultural traditions and lost cultures (Libyco-Berber and Mauritanian, Roman, Christian and Arabo-Islamic) since High Antiquity until the Islamic period.

FIGURE 1 (previous page): The site of Volubilis enjoys an unspoilt location within the landscape.

Criterion (vi): The archaeological site of Volubilis is rich in history, events, ideas, beliefs and artistic works of universal significance, notably as a place that, for a brief period, became the capital of the Muslim dynasty of the Idrisids. The town of Moulay Idriss Zerhoun adjacent to







FIGURE 2: Volubilis is one of the most important Roman sites in North Africa with a wealth of significant archaeological remains, for example, the Basilica (above left), the Triumphal Arch (above right), and the mosaic in the House of Orpheus (left).

the site houses the tomb of this founder and is the subject of an annual pilgrimage (UNESCO 2017).

The site covers an area of 42 hectares (Figure 3) and is surrounded by a buffer zone of a further 4,200 hectares, making it one of the largest buffer zones approved by the World Heritage Committee. As part of the management planning process, land ownership of the property has been established and a cadastral plan of the core and buffer zones at Volubilis has been prepared.



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FIGURE 3: Volubilis is an extensive site covering over 42 hectares.



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FIGURE 4: Olive oil mills are an important feature of the Volubilis area and many survive within the archaeological area. One mill was chosen to be presented to the public and a protective shelter was designed that was inspired by traditional Moroccan roofing.

Existing conditions or planned protective measures

The main factors affecting site preservation are natural ones: heavy rains infiltrate into and under the archaeological structures, causing the potential risk of collapse. In several places the remains are covered by abundant vegetation and the roots cause the structures to crack. The structures are systematically weeded, cleaned and consolidated to prevent serious decay of the remains.

Example shelters

There are two examples of shelters in Volubilis: the first covers an olive oil mill and the second protects the baths dating to the Idrisid period. In both cases the shelters were built as part of a wider conservation programme for the restoration of roofing.

Volubilis contains 58 mills throughout the archaeological area. In general, olive oil mills consist of the mill itself with its grinding wheel, as well as an oil press with its winch system, a counterweight, a crossbar and supports, a basin to collect the oil and sometimes an additional settling basin. In order to raise awareness of the wealth of mills at Volubilis and aid public understanding of the way in which olive oil was extracted, one mill (N 35) was restored and provided with a protective shelter (Figure 4). The shelter consists of a simple roof made of wooden joists and reed battens covered with a waterproof layer of lime, sand and clay. As





FIGURE 5: The Idrisid Baths are an important medieval bath complex; a shelter was installed both to protect the monument and present the archaeology to the public.

there was a lack of archaeological evidence to inform a reconstruction of the original roof, the shelter was instead inspired by traditional roofs still used in Morocco to cover stone and adobe buildings. Stones were collected on-site for the walls and the ancient technique of *opus africanum* – commonly found at Volubilis – was used. New wooden and basketry elements were installed so that the mill could be reconstructed as faithfully as possible. The shelter protects the equipment installed within the mill from the elements and gives visitors an idea of how olive oil has been extracted in Volubilis since the Roman period. This project was carried out thanks to a partnership between Conservation for the Site of Volubilis and the Lycée Paul Valery Meknes, an international school.

The medieval baths of Volubilis are instead located on the southeast side of the site, outside the Roman defensive walls. They were built over an area of 243 m^2 and bound on one side by the Khoumane river. This bath complex was laid out in five sections arranged in a square and recent studies have allowed these to be dated to the Idrisid period (late eighth/early ninth centuries AD). The project for these early Islamic baths aimed to preserve the archaeological remains and reconstruct the bath structure for public presentation. The Idrisid Baths are the only monument in the city that has retained part of its original roof and this was used as the basis on which to plan the restoration project, especially where the warm and hot rooms were vaulted (Figure 5). In order to conserve the highly decayed sections of the original roof and restore the missing parts, work was first carried out to consolidate, stabilize and restore the walls and floors. Some areas of the structure were then chosen for reconstruction, for functional and protective reasons. A wooden frame was constructed within the ancient building to fit the shape of the vault and this rests on the consolidated walls. The reconstruction of the roof required the use of additional beams and brick pillars to support the structure. In order to prevent water infiltration, a waterproof layer was applied on top of the wooden planks. Bricks covered with waterproof mortar made from lime, sand, ceramic and brick powder were then placed on top. The vault has been saved and the remains of the bath complex have been protected, while respecting the original shape of the building. The restoration project took place thanks to the support of the World Monuments Fund and the Volubilis Project of University College London and the Institut National des Sciences de l'Archeologie et du Patrimonie.

The management context

Legal framework or mandate

The site is protected by:

- A *dahir* (royal decree) of 19 November 1920, which defined and established a protection zone around the ruins of Volubilis.
- A *dahir* of 14 November 1921, which better defined the protection of Volubilis and banned any construction in the area surrounding the site.
- Law 22-80 on the conservation of historic monuments and sites, inscriptions, art objects and antiques (1980) and Law 19-05 modifying and completing Law 22-80 (2006).
- World Heritage obligations as part of the World Heritage property of the Archaeological Site of Volubilis (1997).

Institutional framework

- Ministry of Culture
- Directorate for Cultural Heritage
- Regional Directorate for Culture in Meknes
- Conservation for the Site of Volubilis

Resources

Over the next ten years, a yearly budget of €100,000 is needed in order to carry out a programme for the management, maintenance and restoration of the site. At the time of writing the allocated yearly budget is about €6,000 although this is likely to change in the future.

There are 35 people who currently work at the site; most of them are custodians.

Heritage processes

An action plan is drawn up at the end of each year for the following year, following a thematic approach (restoration, research, gardening, maintenance of administrative and scientific buildings, signage, etc.).

Outcomes are presented in an annual report that is submitted internally to the Ministry of Culture.

The existing management system has enabled a large number of goals to be reached. However, the shortage of financial resources does mean that not all desired actions can be achieved.

About the author

Mustapha Atki is an archaeologist who is responsible for the archaeological site of Volubilis for Morocco's Ministry of Culture. He was formerly the assistant curator of the archaeological museum of Rabat.

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Evin Erder

Arykanda, Turkey

The site

The site of Arykanda is an ancient city located near Finike and Antalya in Turkey, which was carefully excavated and preserved by Cevdet Bayburtluoğlu of Ankara University for many years. The current management of the site is directed by V. Macit Tekinalp of Hacettepe University and his colleagues from other universities in Turkey.

Arykanda is a Roman and Late Antique site located on a steep hillside, on a major trade route leading up from the Mediterranean to the plateau above. Its cultural values are connected to a number of buildings including a theatre, both political and commercial agoras, a *bouleuterion*, stadium and baths (Figure 1). The site covers an area of twenty hectares and is quite complex given that it is located on a hillside. Visitors and the local community initially view the site from the road that passes below. A well-designed walkway and signage lead visitors to the various areas of the site (Figure 2).

Arykanda already has several shelters that were constructed to protect its mosaics. However, additional shelters are required for further mosaic protection, together with specialist scientific and technical assistance for their conservation.

Existing conditions and protective measures

The main conservation challenges at the site have been the conservation of the Fellows Tomb, *in situ* mosaics, neighbourhoods and the surrounding context. The main causes of decay are rainwater, freeze-thaw cycles and gradual erosion, especially of the limestone. As can be seen at the Fellows Tomb, the limestone features at the site are being eroded by alveolization in certain areas and cracking in others. However, in spite of this, the site, its materials and architectural features are remarkably well preserved.

The existing shelters were installed to cover mosaics at the site; however, some mosaics do not yet have shelters to protect them and others are set in concrete. Some mosaics require maintenance programmes, rainwater management, visitor management, etc. to reduce the causes of decay at the site. Maintenance programmes are already taking place.

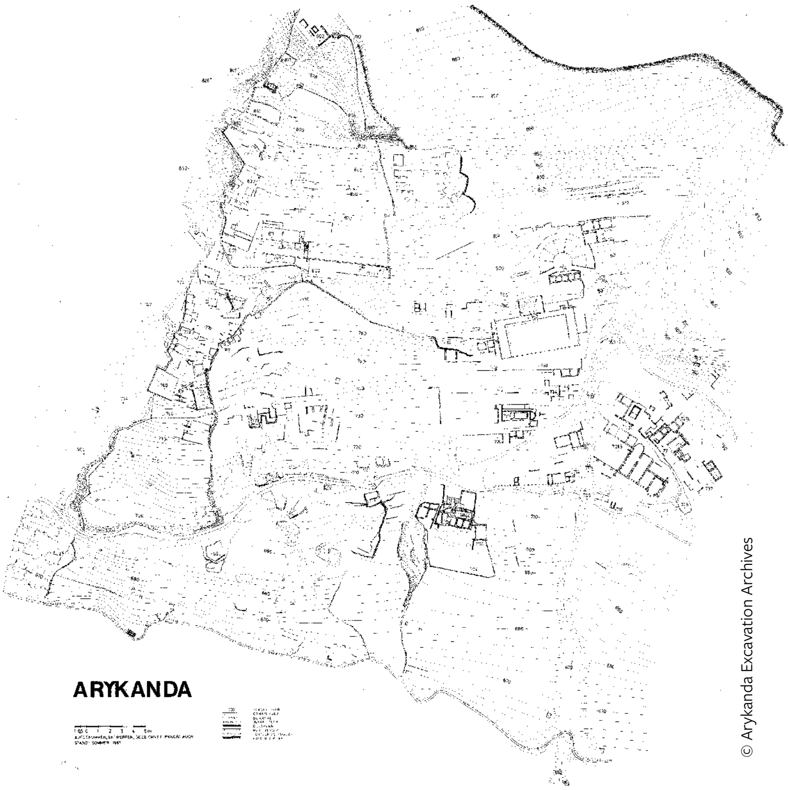


FIGURE 1: Plan of Arykanda showing the location of the various structures that make up the ancient city spread over the hillside.

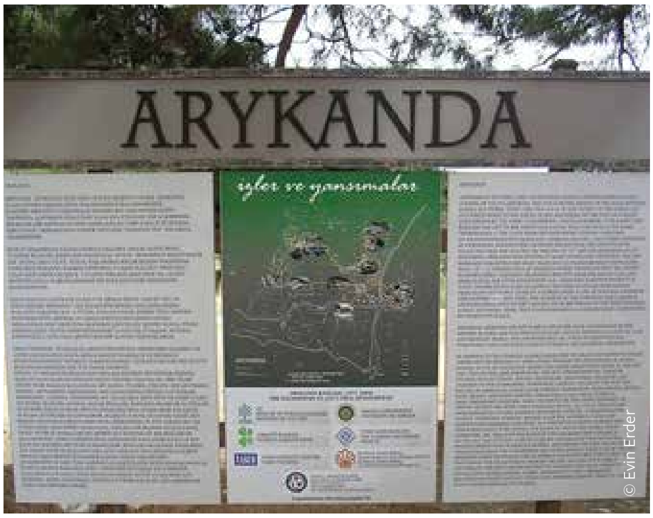




FIGURE 2 (top): Signage at the entrance to Arykanda.

FIGURE 3 (above): View of sheltered mosaics at Arykanda.

Example shelters

The existing shelters at the site have been built with locally available materials, mainly corrugated metal, timber and steel posts, and blend in well with the site (Figure 3). The shelters do not cause any additional management problems but rather enhance the site; however, some mosaics do require conservation. The shelters were designed and erected shortly after the excavation of the mosaics.

New shelters are planned for the site over unsheltered mosaics; the mosaics at the site also require conservation in their existing context, *in situ*, with lime mortar or other appropriate materials. Certain mosaics have also been lifted in the past, using cement, and placed at the excavation house. Whether they will continue to be well preserved remains to be seen.

The management context

Legal framework or mandate

The primary legal framework was established by Turkey's Ministry of Culture and Tourism. The site is a First Degree protected site and all actions there must be approved by the Regional Conservation Committee.

Institutional framework

The primary institutional framework was set up by the Ministry of Culture and Tourism and the General Directorate of Monuments and Museums.

Resources

Financial resources: The funding available for the site's management and its conservation on a yearly basis varies. This funding is provided by the Ministry of Culture and Tourism and spent at the site based on the annual excavation and conservation requirements.

Human resources: approximately 30 people work at the site, including the site director, V. Macit Tekinalp, several archaeologists and academics, administrative and technical officers, external consultants, student interns, workers, etc. As previously mentioned, all activities are funded by the Ministry of Culture and Tourism. All team members, including some fifteen students, oversee the excavations and conservation work at the site.

Heritage processes

Planning is led by the site director, who could otherwise be called the project manager, mainly with the academic staff on a five-yearly basis with annual monitoring. There is a participatory and thematic approach to planning.

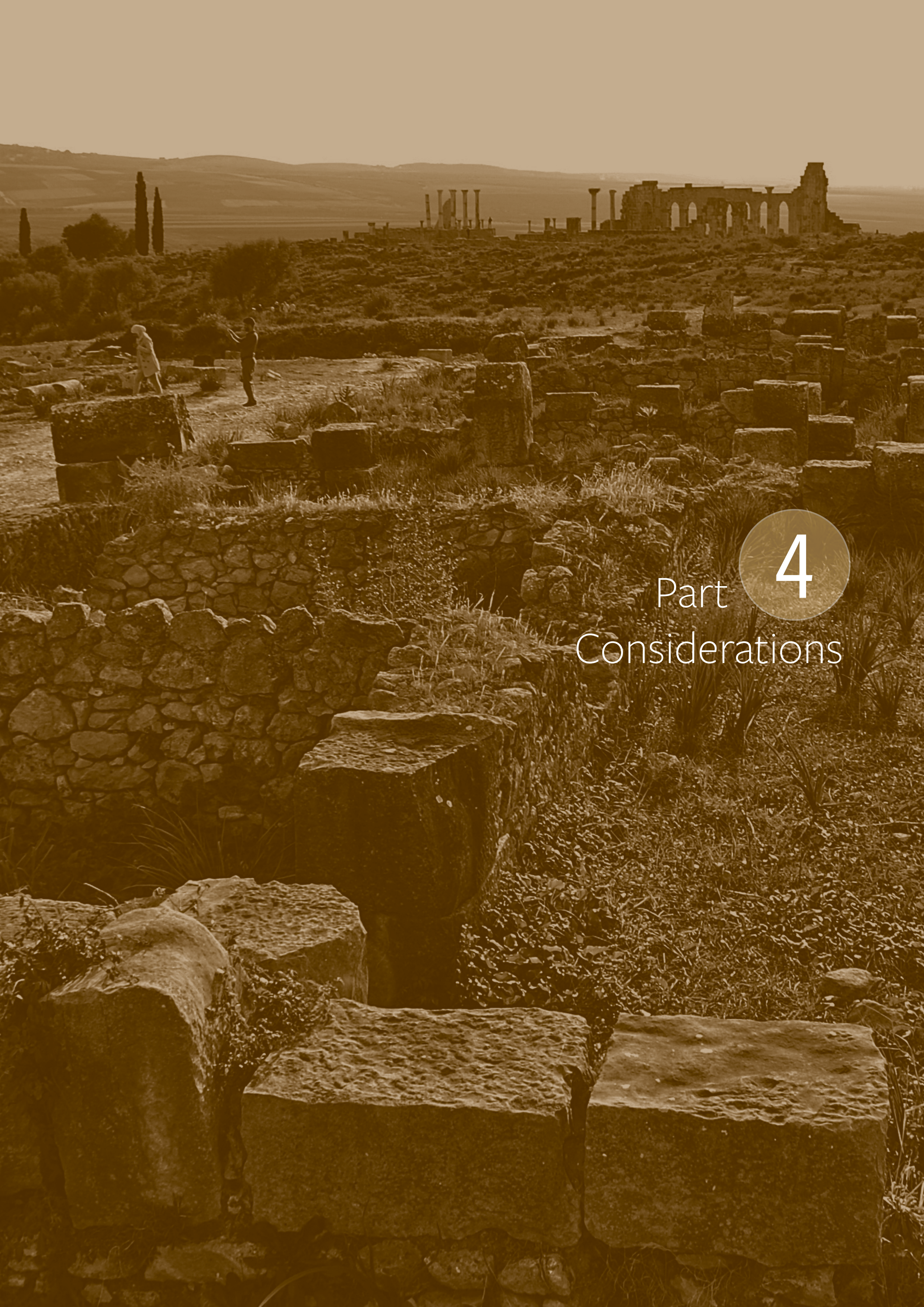
Projects are then implemented by the site staff under the direction of the site director. The results are delivered by the team to the Regional Committee for Conservation and the Ministry of Culture and Tourism.

At the time of writing, the management team has carried out the actions required to reach management and conservation objectives for the site over the last several years. However, additional financial and technical support is required for the conservation of the mosaics. The team at the site regularly monitors actions at the site to check and evaluate the efficiency and effectiveness of approaches being used.

About the author

Evin Erder is an architectural conservator who works as Lecturer at the Middle East Technical University in Turkey. She has been part of the project team at Arycanda since 2001 and has also led the team at the site of Gordion.

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Part 4
Considerations

Considerations

The case studies presented and the professional experiences shared during the Symposium on Protective Shelters for Archaeological Sites clearly demonstrated that it is still a challenge to achieve effective protection for archaeological sites with shelters and secure the other benefits shelters can bring. Decisions regarding when, where and how to install a shelter are all too often made without any reference to learning from other sites and existing publications. At the closing event of the symposium, participants acknowledged the importance of their collective experience of sheltering heritage within the Mediterranean region, where both common ground and differences between their sites and countries stimulate debate. The opportunity for exchanging views on practice in the field and recognition of the value of this shared knowledge led to the participants providing their own conclusions on the subject of sheltering in a lively discussion session on the closing day of the symposium. Indeed, the following notes record the key points of the group's week-long reflections on existing practice and opportunities for raising standards in this field. The participants matured further insights on return to their respective sites and countries and these enriched the writing-up of their case studies for this volume.

The responsibilities that come with excavation

The need to protect and conserve archaeological heritage, with the resulting need for resources, emerges before, during and after excavation has taken place. Therefore, at the point that an archaeological project is being contemplated, conservation and its requirement for adequate funding need to be taken into consideration.

This approach is best implemented if national policy guides it and there are examples of this in practice: in some countries in the region there is a preference for no new excavations, while in others a certain percentage of the budget for archaeological projects must be dedicated to conservation. Many such options exist and are being tested for efficacy, however in each case they will require commitment at policy level to be effective. Moreover, it is important to stop separating the pursuit of archaeological knowledge from conservation and to redress the balance of the budget allocated to new research and to long-term conservation activities.

Discussion of this subject should encourage cooperation across disciplines rather than the perception of conservation and archaeology as mutually exclusive practices. It is not helpful to suggest that archaeologists are irresponsible by carrying out research, nor is it ethical to leave conservation challenges to the conservation sector or public authorities alone. Instead it should be recognized that conservation will ensure that archaeological remains are available for future research and that archaeologists have an important contribution to make when shelters or other site infrastructure are considered so that no archaeology is unwittingly disturbed during site works.

Archaeologists, however, should be encouraged to overcome weaknesses in many excavation campaigns, such as the tendency to address only the conservation needs of small portable finds, instead of also guaranteeing the stability of immoveable heritage. They should also be encouraged to use non-destructive techniques wherever possible and prioritize research projects that focus on the importance of archaeology that is already exposed.

The responsibilities that come with archaeological research should also translate into a process of understanding and presenting the site at the end of the excavation. Options such as sheltering or reburial should be discussed and decided in the context of management, conservation and interpretation plans, which involve multiple experts and stakeholders.

The problem of existing protective shelters

There are examples of protective shelters around the world that demonstrate the conservation problems that a shelter can create when it has not been designed to meet all technical requirements. Shelters can accelerate or provoke decay by changing environmental conditions. They may be ineffective in their protection, for example when shelters without enclosed sides offer no protection from raking light or driving rain. Direct damage may be caused by shelters, such as through the misplacement of footings or where appropriate water drainage has not been provided.

Shelters can lose their effectiveness easily if they are not maintained regularly and can even become the primary cause of damage to archaeology if they are left to rust or collapse. In some cases, maintenance access has not been incorporated into the initial design, which would have limited such problems.

Existing shelters can also date from an era when the complexity of heritage values associated with an archaeological site and its setting were not fully understood and, beyond technical problems, compromise visitation and understanding of the site.

Given the potential for the shelter itself to create conservation problems they should only be installed after careful evaluation, including consideration of all alternatives.

Thinking of the shelter in context

An early step in the sheltering process should be the identification of the significance and values of the archaeological site and its setting – not just of the isolated monument to be protected – so that the shelter can be designed to enhance those values and not erode them.

Architects and engineers should actively recognize that they are not designing a structure in isolation but in a specific cultural and management context and in relationship to assets which are the collective 'property' of humankind. Challenges include how to introduce new architectural languages that are harmonious with the heritage values of an ancient site, as well as how to build consensus around decisions among all communities involved.

Shelters should not just be designed to protect archaeology from a current conservation problem; they should also be designed to address or avoid other issues that may arise in the future, including those caused by the addition of the shelter itself. In particular, shelters need to be designed with their own long-term maintenance in mind but also with an understanding of how they will alter wider site management needs.

A shelter should not only be specifically tailored to the needs of the archaeology and the wider site within which it will be built, but also designed for the specific management system. A range of management issues need to be considered in the design phase: the required lifespan of the shelter (e.g. temporary, mid- or long-term), the available budget for construction and maintenance thereafter, the intellectual and human resources needed for all phases of the shelter's life, etc.

Shelter designs should not only be responsive to the management system but also actively seek opportunities to provide the best conservation solution within the restraints of that system. For example, by designing a shelter for the mid-term when it can be foreseen that a temporary shelter would be at risk of remaining in place too long or by producing a design that can be implemented in phases when that corresponds better to the availability of resources.

Gathering information to inform design solutions

The specialist overseeing the project to improve conservation measures should assemble existing documentation on the archaeology that needs to be protected/sheltered and the wider archaeological site and its management context; and then identify information gaps that need filling before planning can be started. Often archival records can reveal changes over time in conservation conditions that can prompt intelligent research and planning.

If a statement of significance does not exist for the site, a project to introduce change such as a sheltering initiative can be a good moment to work with stakeholders and enhance understanding of the heritage values of the site and its setting and who holds these values. This analysis will inform and shape the planning process.

A condition survey of the archaeology to be sheltered within its wider context is important as it provides a baseline against which to plan the shelter and monitor its performance over time.

Shelter design also needs to respond to the specific environment in which a shelter will be located: once the causes of decay are identified, climatic conditions need to be considered too (climatic design).

Other documentation and plans for the site need to be consulted, such as, where they exist, site surveys, the management plan, risk mitigation plan, conservation plans, interpretation/site presentation plan, hydrological reports, etc.

Usually the information can be collected without requiring large budgets and a great deal of technology; the essential data should be judiciously gathered to inform the sheltering project at hand.

Continuous care of protective shelters

A shelter should not be installed on an archaeological site without measures already in place for its long-term monitoring and maintenance, including for the areas around it. These should be drawn up and implemented by a multidisciplinary team. Like any other building, protective shelters require continuous care for their entire lifetime.

Although the financial resources for many shelters are often provided in the form of one-off capital funding, some of this funding should be allocated for maintenance over time or alternative funding streams need to be identified to guarantee this.

Different elements of monitoring and maintenance will need to be carried out on different schedules (e.g. daily, weekly, monthly, yearly), with some flexibility built into the maintenance programme to enable it to respond to the results of monitoring.

The presence of protective shelters at archaeological sites that are now considered historic in their own right, such as the shelters created by Amedeo Maiuri in the first half of the twentieth century at Herculaneum, should prompt reflection on how shelters created today are a product of their time. Existing shelters may become a part of the archaeological site's cultural significance and this can influence how new interventions are broached. The shelters that are being installed now might need to be effective in 50 years' time and, as a result, will have some sort of impact on the site's heritage values.

Human and financial resources

A multidisciplinary approach is needed to sheltering. A team may need to include, among others, the following specialists: archaeologists, conservators, architects, engineers, project

managers, water management specialists, conservation scientists, surveyors, landscape architects, fundraisers, heritage interpreters, and others according to the specific project.

Archaeological projects often manage to obtain funding for results-based research projects or by attracting public attention for discoveries; the conservation sector needs to gain similar broad-base support. By becoming better at demonstrating the contribution heritage can make to contemporary society and involving more stakeholders so that they have an increased sense of ownership, conservation projects might be able to tap into human and financial resources available in civil society. A greater ability to measure (both in quantitative and qualitative terms) and communicate the effectiveness of initiatives such as shelters for the well-being of the site and its visitors can increase the credibility and transparency of conservation activities.

Many traditional forms of financial resources for shelters, e.g. capital funding from institutions such as national governments or the European Union, come with restrictions on how the money is spent and this can compromise the final result of a conservation project. For example, funding that is spent on a new protective shelter but where no provision is made for its maintenance may well end up causing more damage to archaeology than it prevents. In such cases where the real needs of an archaeological site cannot be addressed, whether or not to accept such a grant should be considered carefully.

In some cases, it may be financially advantageous to repair and maintain existing shelters rather than plan for a new one. In others, where there are limited amounts of financial resources, a decision might be taken to dismantle a shelter entirely (in favour of reburial, for example) or only to introduce new shelters on a seasonal basis.

Considering alternatives to shelters

In many cases, shelters should be considered a final option for the protection of archaeological remains as there are many alternatives available for site preservation, while there are few examples of effective shelters.

Where the archaeological features are robust enough, ground-level measures like improved drainage together with continuous care may be enough to ensure their *in situ* conservation over time.

Where archaeology needs more protection, reburial is an option that can ensure survival of remains either permanently or until resources are available for alternative solutions. In these cases some resources will be needed to monitor conditions during burial and it may be advantageous to provide alternative access to the site e.g. through making available graphic documentation or digital models.

Where shelters already exist but do not provide protection or create additional damage, improvements should be made or the shelter needs to be dismantled. In such cases, it is better to address the conservation needs of an archaeological site without also having to tackle the additional damage that a shelter can cause.

Education and training

There is much need to build awareness around examples of good practice in the Mediterranean that could inspire approaches at other sites with shared characteristics. Continuous professional development, like the Symposium on Protective Shelters for Archaeological Sites, allows experiences in the field to be shared among peers and standards of practice to be raised. Regular publication of experiences of heritage management practice in archaeological sites, especially case studies evaluated over time, is of particular use to practitioners.

The conservation sector needs to overcome the excessive focus on the care of moveable finds and broaden it out to the continuous care of immoveable heritage too. Within the architectural conservation sector, conservation should be given more emphasis as a management process of heritage values assigned by different groups, not just as a technical reality. With regard to shelter design, architecture students need training to marry the concept of a shelter that meets the needs of human beings with that of a shelter that meets the needs of the shared heritage it protects, together with its setting.

Within the archaeology sector, conservation needs to become ever more integrated into teaching so that students grasp the responsibility that they take on when they excavate. Moreover, due importance needs to be given to archaeological conservation activities as an opportunity to create new forms of archaeological knowledge.

The public

Heritage exists because a series of individuals and groups assign values to a specific place and its features. As a collectively owned asset, access for the public should be provided wherever possible but the public should also take part in decision-making processes for its management and protection. In the case of sheltering, this means taking into consideration local community perceptions and the visitor experience when designing a protective shelter. Issues that arise can be addressed with a strong understanding of the attributes that convey the heritage values of the site. These could include: visual impact to, from and within the site; the readability and presentation of the ancient remains; connections between areas of a site; historic routes; authenticity; physical comfort; etc.

Shelter projects take place within wider heritage management systems that must also give due consideration to broader public participation where appropriate, as this, among other advantages, promotes a sense of ownership and can contribute to wider conservation aims.

Shelters and other site infrastructure need to be carefully considered so they do not give the impression of physically, visually or socially excluding local residents.

A range of stakeholders, including those within the local community, can contribute resources to heritage conservation, including shelter projects, if relationships are formed and opportunities are provided to recognize their contribution. In addition, they can assist in highlighting the positive role of the heritage place in contributing to local sustainable development and greater well-being for the communities surrounding the site.



Symposium Participants

Note: This list reflects the titles and affiliations at the time of the symposium, September 2013.

Yael Alef, Architectural Conservator, Israel Antiquities Authority, Israel

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Aïcha Ben Abed, Regional Coordinator, MOSAIKON

Christian Biggi, Manager, Herculaneum Centre, Italy

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Abdelkader Chergui, Conservateur du site archéologique du Chellah et du site des Oudaïa, Direction du Patrimoine Culturel, Morocco

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Evin Erder, Lecturer, Middle East Technical University, Turkey

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Samar Karam, Archaeologist responsible for Northern Lebanon, Directorate General of Antiquities, Lebanon

Joseph King, Unit Director, Sites Unit, ICCROM

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Demetrios Michaelides, Professor of Classical Archaeology, University of Cyprus, Cyprus

Jacques Neguer, Head of Art Conservation, Israel Antiquities Authority, Israel

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Jane Thompson, Project Manager, Herculaneum Conservation Project, Italy

Jean Yasmine, Project Manager for Archaeology, Cultural Heritage and Urban Development Project, Council for Development and Reconstruction, Lebanon

Addressing the often overlooked issue of protective shelters for archaeological heritage, this book records the results of a week-long symposium that used the ancient city of Herculaneum as an 'open-air classroom'. The symposium brought together heritage professionals from ten countries around the Mediterranean and beyond to compare and build on each other's experiences of sheltering heritage.

The partners of the MOSAIKON initiative (the Getty Conservation Institute, the Getty Foundation, ICCROM and ICCM) worked with the British School at Rome and the Herculaneum Conservation Project to gather participants representing a cross-section of disciplines and a range of case studies that captured the challenges of conserving and managing archaeological heritage in the twenty-first century.

The emphasis on experience at a site level, together with the involvement of international professionals with relevant expertise regarding shelters, has allowed the resulting publication to push the discourse forward regarding protective shelters for archaeological sites. It captures progress made but also outlines some key considerations and guiding principles for heritage practitioners facing decisions about archaeological shelters.

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ISBN 978-0-904152-79-1
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